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FOURTH ANNUAL REPORT

ON THE

NOXIOUS AND BENEFICIAL INSECTS

OF THE

8-26-63

STATE OF ILLINOIS.

BY WILLIAM LeBARON, M. D.,
STATE ENTOMOLOGIST.

SPRINGFIELD:
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INTRODUCTION.

[Fourth Report.]

To His Excellency, John L. Beveridge,
Governor of the State of Illinois:

Sir—I herewith transmit my fourth annual report upon the injurious and beneficial insects of the State of Illinois.

In this report I have carried out the plan proposed in the introduction to my last report, of continuing the work there commenced under the title of Outlines of Entomology, so far as to complete the order of Coleoptera or beetles. As stated in the introduction just referred to, my object in this undertaking is to simplify and facilitate the study of this extensive and difficult science, for the benefit of those who may be interested in it, and who, it may be presumed, will comprise a considerable number of the young people of the State, under the stimulus recently given to the prosecution of this class of studies by the legislative enactment which requires that the study of natural history shall constitute one of the branches of education to be taught in the public schools.

The continuation of this work, however, so as to embrace all the orders of insects, would require more time and study than could be devoted to them consistently with the proper discharge of the more directly practical duties of this office. I shall not therefore attempt to continue it any further, at least for the present. But as the study of the several orders of insects is, to a great extent, independent of each other, the present work, it is hoped, will be found equally useful to the student, so far as it goes, whether the remaining parts ever be completed or not. With the view of making the part now published as complete in itself as possible, I have appended to it a glossary of the scientific terms more commonly used in descriptive entomology, and also a list of the principal authors, in this branch of science, both European and American.

As the present report is a continuation of the preceding, or third annual report, and will undoubtedly fall into the hands of many who will be unable to procure copies of the other, I have reprinted, with some alterations, the concluding portions of the last report, which forms a natural introduction to the present.

I may here add that the lateness of the date at which the bill for the appropriation for the purpose of illustrating this report passed the General Assembly, and the time required for preparing the engravings, have necessarily caused a delay in the publication of this report of several months beyond the usual time.

I also deem it proper here to put on record, that the preparation of the above mentioned bill, and its passage through the General Assembly, were largely due to the interest and exertions of that well known friend of popular education, the Hon. Elmer Baldwin, of LaSalle county.

Respectfully submitted.

WILLIAM LEBARON,
State Entomologist.

GENEVA, *September* 1, 1874.

OUTLINES OF ENTOMOLOGY,

PUBLISHED IN CONNECTION WITH THE AUTHOR'S

ANNUAL REPORTS UPON INJURIOUS INSECTS.

PART FIRST.

INCLUDING THE ORDER OF COLEOPTERA.

BY WILLIAM LeBARON, M. D.,
STATE ENTOMOLOGIST OF ILLINOIS.

PREFACE.

It is the object of the present work to simplify and facilitate the study of entomology, and especially to aid the inexperienced student in classifying the insects which he may from time to time collect.

With this end in view I have made use, as far as practicable, of obvious and conspicuous characters in preference to those which are more minute and obscure, and consequently of more difficult application. I have therefore made much use of the general characters of size, shape and color, but only so far as could be done consistently with the established classification of insects, founded upon their more permanent organic characters.

In treating the Coleoptera, for the purpose of keeping in view the connection between scientific and practical entomology, I have endeavored to classify them, as nearly as possible, in accordance with their food-habits, it being in the nature of their food and their modes of procuring it that insects come into the most direct relation to human interests; and this arrangement does not materially differ, so far as relates to the larger divisions, from that already established by LATREILLE and other entomologists, mostly upon structural considerations. This mode of classification is particularly interesting and available in the order of Coleoptera, on account of their much greater diversity of habits in these respects, than that of any of the other orders of insects.

In classifying the Coleoptera I have not included a few small families, and a much larger number of small genera, thinking it best not to confuse the mind of the inexperienced student by the description of too many divisions, many of which contain but a few rare species, or else, are so similar to other and previously established genera that their separation is a matter of questionable utility. Neither have I been able, without greatly extending the size and scope of this work, to take into account many of the new species which have been brought to our knowledge by the recent explorations of the more western portions of the continent. The reader who wishes to extend his researches to these remote States and Territories, is referred more particularly to the various writings of Dr. LECONTE, and the revision of the Tenebrionidæ of North

America, and other memoirs, by Dr. GEO. H. HORN. But whenever a general enumeration of the species in any group is given, without qualification, it must be understood to embrace all the known North American species. In stating the numbers of species, I have followed, for the most part, the recently published Check List of Mr. G. R. CROTCH, (1874). Where two or more closely allied genera or sub-genera are merged in one, all the species are, of course, included under the leading generic title. A precise adjustment of species formed no part of my plan, and my principal object in giving these numbers has been to show the comparative numerical importance of the several families and their leading or typical genera.

In the definition of genera I have had constant reference to the great work of LACORDAIRE on the genera of Coleoptera*; and to Dr. J. L. LE-CONTE'S very accurate and scientific classification of the Coleoptera of North America, prepared for the Smithsonian Institution. (Part 1st, 1 vol., 8 vo., 1861; and Part 2d, 1873.) To these elaborate systematic works, and especially the latter, which, for obvious reasons, is most readily available to the American student, the present treatise is only intended to serve as an introduction or stepping stone; and to them the reader is referred for more extensive details, and for the definition of the smaller families and genera not included in the present work.

In the families Chrysomelidæ, Erotylidæ, Endomychidæ and Coccinellidæ, which have not been reached in either of the uncompleted works just referred to, I have derived valuable aid from the synopsis of these families by Mr. G. R. CROTCH, recently published in the Proceedings of the Academy of Natural Sciences of Philadelphia, and in the Transactions of the American Entomological Society.

In treating of the internal structure of insects I have necessarily limited myself to the briefest general statements. Those who wish to prosecute further this department of the science, will find much interesting matter in Dr. A. S. PACKARD'S well known Guide to the study of Insects.

It will be seen that some of the families of Coleoptera are much more fully treated than others. This has been owing, partly, to the greater amount of material at my command, partly to the comparative importance of certain families in a practical or economic point of view, and partly to the irregularity of the intervals at which the work has been prosecuted, which has prevented that uniformity of execution which would have been desirable.

In order to make this little work as useful as possible, I have added a glossary of the terms most commonly used in descriptive entomology; and also, a brief catalogue of authors, especially those whose names ap-

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Genera des Coleopteras. Ten vols. 8 vo., Paris, 1854-1872. The author died before the completion of this work, and the tenth volume has not yet been published.

pear in connection with the descriptions of North American Coleoptera, or the elucidation of their natural history.

Much of the value of a work intended, like the present, for the inexperienced student, must depend upon accurately executed figures of the insects treated of, and the details of their organization. An appropriation for this purpose by the General Assembly has enabled me to illustrate the present work to a reasonable extent. Most of these figures have been drawn by Mr. C. V. RILEY, State Entomologist of Missouri, and engraved under his direction, which is a sufficient guarantee of their accuracy. Many of these have already been published in illustration of his own official reports, but a considerable number of them have been prepared originally for this work. A small proportion of the figures have been obtained from Dr. Packard's Guide to the study of Insects, from Westwood's Introduction, and a few from other sources.

The straight hair-line frequently placed at the side of a figure, shows the natural length of the insect.

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SYNOPSIS OF THE TRIBES OF THE COLEOPTERA.

A. Tarsi usually 5-jointed, sometimes 4 or 3-jointed in very small species, slender and sparsely haired, except Tribe XI, and except that the anterior, or anterior and middle tarsi are sometimes dilated and brush-like beneath in the males.

B. Elytra covering the whole or nearly the whole of the abdomen.

C. Antennæ filiform and simple; outer lobe of maxillæ palpiform, giving the appearance of six palpi.

D. Legs long and fitted for running, hind trochanters large, egg-shaped and prominent; tarsi always 5-jointed ....Tribe I.

D D. Hind legs flattened and fringed for swimming; trochanters not prominent; the fourth joint of the anterior and middle tarsi sometimes indistinct in very small species ....Tribe II.

C C. Antennæ filiform and usually serrate; outer lobe of maxillæ not palpiform.

E. Prosternum prolonged to a point behind and received in the mesosternum; body very firm, legs short, tarsi always 5-jointed, joints not dilated and brush-like beneath, but often furnished with membranous lobes on the under side...Tribe IX.

E E. Prosternum not prolonged behind.

F. Body moderately firm; legs more or less elongated; tarsi various: Tribe X.

F F. Body soft, elytra thin and flexible; tarsi usually somewhat dilated and brush-like beneath, with the fourth joint bilobed; last joint of palpi sometimes dilated.........................Tribe XI.

C C C. Antennæ clavate or capitate.

G. Palpi usually very long, sometimes longer than the short antennæ; antennæ 6 to 9-jointed, strongly clavate; middle and hind coxæ dilated; middle and hind tarsi sometimes fringed; habits aquatic. Tribe III.

G G. Palpi not elongated; antennæ 11-jointed, rarely 10 or 9-jointed; coxæ not dilated; habits not aquatic.

H. Club of antennæ pectinate; mandibles usually strongly toothed or even branched; size large, or medium ....Tribe VI.

H H. Club of antennæ lamellate; size often large; sometimes small, but never very small.

I. Abdomen wholly covered by the elytra (except Copridæ); hind legs set far back..................................Tribe VII.

I I. Tip of abdomen exposed; hind legs not set far back. Tribe VIII

H H H. Antennæ clavate, but with the club neither pectinate nor lamellate, and nearly or quite filiform in the exceptional group of Sub-clavicornes; size small or very small, (except Silphidæ)..................................Tribe IV.

B B. Elytra much shortened, usually covering less than half of the abdomen; antennæ more or less moniliform ....Tribe V.

A A. Anterior and middle tarsi 5 jointed, hind tarsi 4-jointed; the joints slender, sparsely haired or spinous, sometimes silky or pubescent beneath, but never dilated, brush-like and bilobed as in the remaining sections; except sometimes the penultimate joint in parts of Tribes XII and XIII.

K. Head as wide as the thorax, and attached to it by a neck; body rather soft and elytra flexible; antennæ filiform, sometimes serrate or pectinate; anterior coxæ prominent and contiguous; colors various, and often diversified; larvæ usually parasitic..Tribe XII.

K K. Head narrower than the thorax, and usually partly inserted in it; body firm; color black or brown; rarely diversified.

L. Antennæ filiform; anterior coxæ somewhat prominent, and nearly or quite contiguous; color mostly brown, sometimes black; larvæ sub-cortical. Tribe XIII.

L L. Antennæ sometimes filiform, but usually more or less clavate; anterior coxæ small, depressed, and never contiguous.

M. Antennæ usually moderately and gradually enlarged towards the tip, but sometimes filiform, and usually as long as the head and thorax; body oblong; color black or dark metallic; larvæ mostly terrestrial. Tribe XIV.

M M. Antennæ usually short and perfoliate; body short, oval or subquadrate; color brown, or black with red spots, sometimes metallic; larvæ fungivorous ....Tribe XV.

A A A Tarsi apparently 4-jointed, with all the joints, except the last, dilated, brush like beneath, and with the penultimate joint usually bilobed, (except Scolytidæ.)

N. Head more or less prolonged into a snout or rostrum; antennæ usually capitate; larvæ fructivorous ....Tribe XVI.

N N. Head not prolonged into a snout.

O. Antennæ clavate or capitate; tarsi not dilated; form sub-cylindrical; size small; color brown or black; larvæ lignivorous...Tribe XVII.

O O. Antennæ usually filiform or setaceous; sometimes slightly widened towards the tip; tarsi always dilated and brush-like beneath, with the penultimate joint usually bilobed.

P. Form elongated; antennæ almost always long, and filiform or setaceous; often as long as the body or longer; size and colors various; larvæ lignivorous..........................Tribe XVIII.

P P. Form short, and more or less oval; antennæ filiform, or a little thickened towards the end, and never much more than half as long as the body; size below medium or small; colors various; larvæ herbivorous ....Tribe XIX.

A A A A. Tarsi usually apparently 3 jointed, sometimes 4 or 5 jointed, the joints dilated and brush-like beneath, with the penultimate joint usually deeply bilobed; antennæ usually strongly clavate, rarely sub-clavate.

Q. Form oval or oblong; antennæ of moderate length; colors red and black, usually arranged in large spots or stripes; habits fungivorous ...Tribe XX.

Q Q Form rounded, or sub hemispherical; antennæ very short; colors mostly red and black, arranged in dots; habits carnivorous ....Tribe XXI.

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OUTLINES OF ENTOMOLOGY.

INSECTS IN GENERAL.

Insects constitute the most numerous and diversified class of the second grand division of the animal kingdom, designated by the term ARTICULATA, and so called because their bodies and limbs are composed of many pieces, connected together by movable joints or articulations.

Insects as a class, and in the widest meaning of the word, comprise three divisions, or sub-classes, commonly known as Spiders, Insects and Millipedes. They may be distinguished by the following characters:

1st. Sub-class: ARACHNIDA, including Spiders, Scorpions and Acari, or Mites. Body divided into two parts, the head and thorax being united in one; legs eight in number; without wings.

2d. Sub-class: INSECTA, or Insects proper. Body divided into three parts, the head, the thorax, and the abdomen; legs six; furnished with wings, in the perfect or *imago* state.

3d. Sub-class: MYRIAPODA, commonly called Millipedes or Centipedes. Body divided into many parts or segments, varying from ten to two hundred; legs numerous; usually either one or two pairs of legs to each segment of the body; never have wings.

The exceptions to these characters are very few. In the Arachnida, some of the most minute Acari have but six legs.

Insects proper are always six-legged in their last or perfect state, and they also generally have six true legs in their larva state; but some larvæ have no legs, and the larvæ of the Lepidoptera, commonly called caterpillars, have, in addition to their six true legs, several pairs of false legs, or pro-legs, which assist in locomotion.

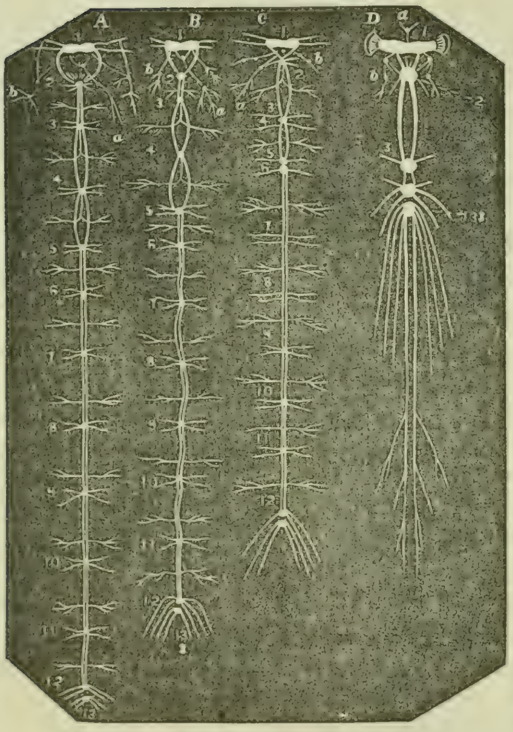
There are a few exceptional cases in which insects are destitute of wings. The Fleas (Pulices), the Lice (Pediculi), and the little family of insects known as Spring-tails (Thysanoura), never have wings. In some rare instances the females are wingless, whilst the males have wings. This is the case with some species of the Lightning-beetles (Lampyridæ), and with the Canker-worm moth, and the Tussock-moth, and a few other species amongst the Lepidoptera. Similarly exceptional cases are also found in other orders of insects.

The present work will treat only of Insects proper.

INTERNAL STRUCTURE OF INSECTS.

THE NERVOUS SYSTEM.

[Fig. 1.]



Nervous system of insects, explained in the text.

The nervous system of insects consists of a double cord extending the length of the body, and lying upon the inferior or ventral side of the internal cavity. The two threads which compose this cord do not lie side by side, but one above the other. The lower thread swells at intervals into little knots of nervous matter, called ganglia. In insects of an elongated form, such as some of the Neuroptera (e. g. Corydalis), and the larvæ of the Lepidoptera, there is a ganglion at each segment of the body, making thirteen in all; but in most mature insects the ganglia become more or less consolidated. In the Butterfly (Papilio), there are ten ganglia, counting the brain as one; in the Bee (Apis), there are eight; in the May-beetle (Melolontha), there are five, and in the Cicada there are but two. The upper of the two nervous threads runs nearly in contact with the lower, but is destitute of ganglia. These two threads seem to represent the double and more compact cord which constitutes the spinal marrow of the higher or vertebrated animals. The upper simple thread is supposed to furnish the nerves of motion, and the lower and ganglionic thread, the nerves of sensation. The fibres which compose these cords separate at the anterior extremity of the body, so as to embrace the œsophagus or gullet, above which they again unite to form the cerebral ganglion or brain, which is somewhat larger than the other ganglia. From the nervous cords, and chiefly from the ganglia, fine lateral threads are emitted, which are distributed to the adjacent parts.

The nerves thus far described represent what, in the higher animals, is called the cerebro-spinal system of nerves, and are sometimes called the nerves of relation, because they control the sensations and motions which associate the animal with the world around it. But in addition to these, there have been discovered a number of very fine nervous filaments proceeding from the brain, and extending down into the body, and furnished with minute ganglia of their own, which are supposed to represent the sympathetic system of nerves which preside over the internal functions, such as those of digestion and secretion.

The foregoing cut represents the nervous system of a butterfly, (*Papilio brassicæ*—after Herold), A exhibiting that of the larva, B that of the pupa, and C that of the perfect insect; and showing how the nervous system becomes shortened and consolidated in changing from the lower to the higher stages. Fig. D. shows the more concentrated nervous system of a Coleopterous insect, as exhibited in the common English Cockchafer or door-beetle, *Melolontha vulgaris*, (copied from Straus.)

THE CIRCULATORY, OR SANGUIFEROUS SYSTEM.

The blood of insects is a colorless fluid, which does not circulate in closed vessels or tubes, like that of the higher animals, but permeates the tissues of the body. The only vessel that can be discovered is an oblong, membraneous, pulsating sack, situated in the upper or dorsal part of the body, and which evidently represents the heart. This is divided into several compartments by cross-valves, which are so arranged as to permit the blood to pass only in a forward direction. The heart is prolonged anteriorly into a narrower tube analogous to the aorta. Through this the blood flows first towards the head, and thence through the body, returning to the heart, which it enters through openings at its sides. As compared with that of the warm-blooded animals, the blood of insects is not only colorless, but small in quantity, and must circulate very slowly, as is proved by the fact that when their bodies are wounded no blood escapes.

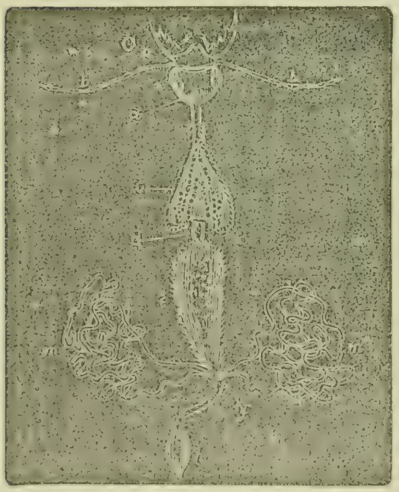
THE RESPIRATORY SYSTEM.

Most of the organs of insects, and their functions, have an obvious analogy to those of the higher animals, but their breathing apparatus is constructed upon an entirely different plan. In all the vertebrated animals the blood is carried in vessels to a particular part or organ of the body, for the purpose of being exposed to the life-giving influence of the air. This part in terrestrial animals, is the lungs, and in aquatic animals the gills. But in insects the process is reversed, and the air is carried to the blood by being distributed to every part of the body in very delicate pearl-white tubes or vessels, which present a beautiful appearance under the microscope. They are called tracheæ, or air tubes. They admit the air through little openings along the sides of the insect's body, called spiracles. The spiracles or breathing pores can be easily seen along the sides of all caterpillars which are not too densely covered with hairs. In the perfect or winged state of insects the branches of the air tubes are dilated into a great number of little vessicles or air bladders, which render their bodies lighter, and thus facilitate their flight.

In some aquatic larvæ the tracheæ project from the body in the form of little tufts, analogous to the gills of fishes. The aquatic beetles are under the necessity of rising to the surface, at intervals, for air, in a manner similar to that of the aquatic mammalia, the whales and the dolphins.

THE DIGESTIVE OR NUTRITIVE SYSTEM.

[Fig. 2.]



Digestive organs of insects, explained in the text.

The digestive apparatus of insects, like that of other animals, consists of an elongated tube called the alimentary canal, extending through the body, and having a number of enlargements in its course, and in many insects presents a particular resemblance to the digestive apparatus of birds. First, there is a short, straight œsophagus or gullet; this expands into a much larger cavity, resembling the crop; then follows a smaller muscular part, analogous to the gizzard; and next, a much larger and longer cavity, which is the true digestive stomach; this becomes contracted into the intestinal canal, which sometimes runs nearly straight through the body, and in other cases is more or less convoluted; the intestine enlarges again before it reaches the end of the body into what is known as the large intestine or colon. As in other animals, the alimentary canal is much longer and more capacious in the herbivorous than in the carnivorous kinds. As a general rule the canal is much more capacious in the larva than in the imago state.

In Fig. 2, *C*, represents the digestive organs of one of the carnivorous beetles, *Cicindela campestris; a* the commencement of the œsophagus or gullet; *c* the crop; *d* the gizzard; *e* the stomach or principal digestive cavity; *f* the commencement of the small intestine; *h* the large intestine; both of these parts are unusually short in this tribe of insects; *m m* the convoluted vessels which are supposed to represent the liver of the higher animals.

THE SECRETORY SYSTEM.

The secretory apparatus of insects, though analogous in function, is very different in appearance from that of the higher animals. Instead of solid glands, like the liver or kidney, it has the form of masses of convoluted tubes, as represented at *m* in the preceding figure. The salivary glands, the liver, the kidneys, and the testacles are found represented in insects. The gastric and pancreatic fluids are secreted by little cells or follicles in the coats of the stomach.

THE MUSCULAR SYSTEM.

The muscles of insects, like those of other animals, consist of contractile fibres, but in their situation and attachments, as compared with those of the vertebrate animals, they are reversed; that is to say, in the latter, the muscles are situated outside of, and upon the bones, which constitute the supporting part of the body, whereas in insects, the supporting part is the external crust, and the muscles are attached to its internal surface. The muscles are of a pale yellowish color, and are usually presented in the form of thin layers, and sometimes of isolated fibres, and are never united into the rounded compact form which they have in the higher animals. By counting the separate fibres, a very great number of muscles have been enumerated. Lyonet counted nearly four thousand in the larva of *Cossus ligniperda*, and Newport found an equal number in the larva of *Sphinx ligustri*. The muscles of insects possess a wonderful contractile power in proportion to their size. A flea can leap two hundred times its own length, and some beetles can raise more than three hundred times their own weight. This remarkable strength may probably be attributed to the abundant supply of oxygen by means of the myriad ramifications of the air tubes.

THE ORGANS OF THE SENSES.

Insects are evidently endowed with the ordinary senses which other animals possess, but no special organs of sense, except those of sight, have been discovered with certainty.

Sight.—The eyes of insects are of two kinds, simple and compound. The simple or single eyes are called *ocelli*, and may be compared in appearance to minute glass beads. They are usually black, but sometimes red, and are generally three in number, and situated in a triangle on the top of the head. In insects with a complete metamorphosis, these are the only kind of eyes possessed by them in their larva state, and in these they are usually arranged in a curved line, five or six in number, on each side of the head. We have noticed that in some insects which undergo only a partial metamorphosis, as for example the common

Squash-bug *(Coreus tristis)*, the ocelli are wanting in the larva and pupa states, but become developed in the last or perfect stage.

The compound eyes of insects present one of the most complex and beautiful mechanisms in the organic world. They are two in number, but proportionately very large, occupying in many insects nearly the whole of the sides of the head, and, in the dipterous order especially, often present across their disks, bands of the richest tints of green, brown and purple. These eyes are found to be composed of a great number of lesser eyes or eyelets, in the form of elongated cones so closely compacted as to form apparently a single organ. The larger ends of these cones point outwards, and by their union form the visible eye. Their smaller extremities point inwards, toward the brain, to which they are connected by means of a large optic nerve. When one of these eyes is examined through a strong magnifying glass, it is seen to be composed of a very great number of little facets, sometimes square, but usually six sided, each one of which represents the outer and larger extremity of one of the component parts. These facets vary greatly in number in the eyes of different kinds of insects. In the ants there are about fifty in each eye; in the Sphinx moths, about 1,300; in the house fly, 4,000; in the butterfly, upwards of 17,000; and in some of the small beetles of the genus Mordella, it is said that more than 25,000 facets have been enumerated in one compound eye; so that if we suppose that each of these component parts possesses the power of separate vision, one of these insects must have more than 50,000 eyes. How vision is effected, or how a unity of impression can be produced by so complex an organ, we are unable to conceive.

Hearing.—Insects are evidently affected by loud noises, and moreover, as many insects have the power of producing voluntary sounds, it is reasonable to suppose that they possess the sense of hearing. No organ, however, which has been generally admitted to be an organ of hearing, has been discovered. It is the most common opinion of entomologists that the antennæ are instrumental in receiving the impressions of sound, and that the sense of hearing is located at or near their place of attachment to the head, and this view is much strengthened by the fact that in some of the larger crustaceans, such as the lobster and crab, a distinct organ of hearing is found located at the base of the antennæ.

Smelling.—That insects are endowed with the sense of smell, is proved by the fact that the carrion-fly, and other insects which feed upon, or deposit their eggs upon, putrescent matter, detect such substances at a distance, however completely they may be hidden from the sight. The bee also discovers honey under similar circumstances, and it is therefore fair to presume that insects are conducted to flowers, in hidden situations, more by their odor than by their visible characters. But no organ of smelling has been discovered, and this sense is supposed, from analogy, to be located in the lining membranes of the spiracles.

Taste and Touch.—It is impossible to determine, but there is no reason to doubt, that insects, like other animals, taste and enjoy the food of which they partake; and the manner in which they frequently touch their food, and the surfaces over which they walk, with the tips of their palpi, which, indeed, have received the common name of *feelers*, renders it probable that these organs are endowed with a special sense of touch.

SOUNDS PRODUCED BY INSECTS.

The songs of birds, and the noises made by other animals, are produced by the forcible passage of air through the glottis, which is the narrow opening at the top of the wind pipe, aided by the vibration of certain muscular folds near the outlet, called the vocal chords. But we have seen that insects never breathe through their mouths, and therefore they never make any oral sounds. But the humming of bees and flies is produced in an analogous manner, by the expulsion of air through the thoracic spiracles, and the vibration of a delicate valve-like fold, just within the opening.

But besides this, insects make a variety of noises, which are produced in different ways. The singing of the Cicada, which is the loudest noise made by any insect, is produced by the expulsion of air from the first abdominal spiracle, striking upon a large transparent drum-like apparatus, situated at the base of the abdomen. The chirping of crickets is produced by rubbing together their parchment-like wing covers. The well-known noise of the katy-did is produced in the same way, but here the sound is intensified by a thin talc-like plate set into the base of each wing-cover. The stridulation of grasshoppers is caused by the friction of their spined shanks across the edge of their wing-covers. The fainter, squeaking sounds, made by many insects when captured, are produced simply by the rapid friction of one part of their bodies upon another; in certain Hemiptera, by the friction of the head upon the pro-thorax; in the Capricorn beetles, by the friction of the pro-thorax upon the meso-thorax; and in some of the Lamellicorn beetles, by the friction of the abdomen against the wing covers.

The more complex and special apparatuses of insects for the production of sounds, are possessed exclusively by the males, and are supposed to be exercised by them as calls to the opposite sex; but the simpler squeaking sounds are emitted by both sexes, and appear to be mere notes of alarm.

THE METAMORPHOSES OF INSECTS.

Nothing in the history of insects is more remarkable than the striking changes of form which many of them undergo, in the course of their development. Whilst other animals progress from infancy to maturity, simply by a process of growth, and by such gradual and imperceptible changes only as their growth necessitates, many insects assume totally different forms in the course of their development, so that they could never be recognized as the same individuals, if this development had not been actually traced from one stage to another. These changes are called the *metamorphoses* or *transformations* of insects. All insects, in their growth, pass through four stages, designated as the *egg* state; the *larva*, or caterpillar state; the *pupa*, or chrysalis state; and the *imago*, or perfect and winged state. The metamorphoses of insects are of two principal kinds, *complete* and *incomplete*.

In the *complete* metamorphosis the larva bears no resemblance to the imago, and the insect, in the intermediate or pupa state, is motionless, and takes no food. This kind of metamorphosis presents two principal varieties. In some (Lepidoptera and many Diptera), the legs and wings are completely inclosed in the pupa case. In others (Coleoptera, Hymenoptera, and some others), the legs of the pupa, though useless, are free, and the rudimental wings lie loosely upon the sides. Moreover, in some (the noctural Lepidoptera, and many Hymenoptera), the pupa is inclosed in a separate covering or cocoon, whereas the majority of insects have no such covering. Pupæ thus inclosed are called *folliculate*. The term *chrysalis*, from a Greek word meaning *golden*, is sometimes applied to the pupæ of the diurnal Lepidoptera, because the pupæ of some butterflies are ornamented with golden spots.

Most insects, in changing from the larva to the pupa state, cast off the larval skin, but in many of the two-winged flies, (Muscidæ, Syriphidæ, etc.) the larval skin becomes contracted and hardened, assumes an oval form and a brown color, and thus forms a compact and closely-fitting case, in which the pupa proper is inclosed, but distinct. Pupæ thus inclosed are called *coarctate*, and their cases are analogous to the cocoons of the Lepidoptera.

In the *incomplete* metamorphosis, the insect presents essentially the same form, and is active in all its stages, after leaving the egg. The pupa is distinguished from the larva by the presence of short rudimental wings at the base of the abdomen, and the imago or adult state is distinguished by the fully grown wings and wing covers. It is only in this last stage that insects are capable of propagation. All the Hemiptera, or bugs proper, and all the Orthoptera, or crickets, grasshoppers and cockroaches, exhibit this imperfect kind of metamorphosis.

In treating of the development of insects it is necessary to refer to the periodical casting of the larval skin. All the growth of insects takes place in the larva state. Consequently no insect increases in size after it has acquired wings. The larval skin seems to be an imperfectly organized membrane, which does not correspond in its growth to that of the body, but yields to this growth, to a certain extent, by virtue of its elasticity. A time comes therefore when it can yield no farther. The insect then evidently becomes oppressed, ceases to eat, usually retires to some secluded spot, and, if gregarious, huddles together with its companions, and there remains a day or two, almost motionless and without food, and in an apparently torpid and sickly condition. After a time the distended skin bursts open, and the insect throws it off, and appears in a new, bright, and elastic skin, which, in its turn, is capable of a certain degree of distension. This process, which is called *moulting*, takes place three or four times in the course of the larval growth, and in a few larvæ which continue more than one year in this state, the moulting is said to occur from five to eight times. In insects of very rapid development, on the other hand, such as the maggots, or larvæ of the Muscidæ, no moulting takes place, and it is the larvæ of this kind which form coarctate pupæ.

THE SEXES OF INSECTS.

As a general rule insects of different sexes resemble each other so closely as to leave no doubt of their specific identity, and in many the sexes can scarcely be distinguished. But this rule is subject to many exceptions, and the naming of insects has been greatly confused by the sexes of the same insect having been described and named as distinct species.

The sexual organs, especially those of the males, are usually concealed so as to be nearly or quite invisible; but the female, especially in the order of Hymenoptera, often have an exserted ovipositor of greater or less length, which readily distinguishes them from the opposite sex. An analogous structure exists in many wood-boring beetles which deposit their eggs in deep crevices in the bark of trees; and more rarely in insects of the other orders. In the Coleoptera the males are sometimes distinguished by one or two horns, either upon the head or thorax, and many of the predaceous beetles, both terrestrial and aquatic, have the anterior feet much widened, and furnished beneath with a cushion of hairs or bristles.

The antennæ usually differ in length but little, if at all, in the two sexes; but in the long-horned beetles (Cerambycidæ) the antennæ of the males are generally considerably longer than those of the females.

In those moths which have bi-pectinate antennæ, these parts are almost always wider in the males. Many insects in the order of Diptera are remarkable for the great size and beauty of their eyes, and these organs are almost always larger in the males than in the females.

♂ ♀ In describing insects it is customary, for the sake of brevity, to distinguish the sexes by signs, as shown in the margin.

male. female.

EXTERNAL STRUCTURE OF INSECTS.

The classification of insects depends chiefly upon the structure of the external and visible parts. It is necessary therefore that the student should have a thorough knowledge of these parts and of the names by which they are designated. But as these parts are very greatly modified in the different orders of insects, we shall reserve a minute description of them till we come to treat of them in connection with the several orders respectively, and shall here give only a general enumeration of them. The student will be much aided in understanding the following description by comparing it with the figure of *Harpalus caliginosus* on a subsequent page.

THE HEAD AND ITS APPENDAGES.

It often becomes necessary to refer to different parts of an insect's head, and they are therefore designated by particular names indicative of their situation. These are—

The Hind-head, (*Occiput*). The Crown, (*Vertex*). The Fore-head (*Frons*). The Face, (*Facies*). The Cheeks, (*Genæ*).

The appendages of the head are the Horns, (*Antennæ*); the Eyes, (*Oculi*); and the parts of the Mouth, (*Trophi*, or *oral organs.*)

The *Antennæ.*—All insects have two more or less elongated and usually many-jointed antennæ situated one on each side of the head, and varying greatly, in different kinds of insects, in length and in the form of their component joints. Insects have very short antennæ in their larva state, and in some perfect insects, such as the water-beetles, (*Gyrini* and *Hydrophili*), the antennæ are not longer than the head, whilst in others, such as some of the longicorn beetles, they are more than twice as long as the whole body, and in some of the small moths of the genus *Adela*, they are five or six times as long. The uses of the antennæ are not known, but, as we have stated above, when treating of the senses of insects, they are supposed to be instrumental in the sense of hearing. The most common variations in the forms of the antennæ are expressed by the following terms. Figures of most of these forms are given on a subsequent page, in treating of the Coleoptera.

Filiform, or *thread-like;* long and slender, and of the same, or nearly the same width throughout.

Setiform, or *setaceous; bristle-like;* long and slender, but tapering towards the tip.

Moniliform, or *bead-like;* when the joints are about the same size, and round, so as to resemble a string of beads.

Serrate, or *saw-toothed;* when each joint is somewhat triangular, and a little prominent and pointed on the inner side.

Pectinate, or *comb-toothed;* when the inner angles of the joints are considerably prolonged.

Bi-pectinate, or *double comb-toothed;* pectinate on both sides.

Clavate, or *club-shaped;* gradually enlarging towards the tip.

Capitate, or *knobbed;* when a few of the terminal joints are abrubtly enlarged.

Lamellate; when the joints which compose the knob are prolonged on their inner side, in the form of plates.

The *Eyes.*—We have briefly described the mechanism of the eyes when treating of the sense of sight. They are uniformly of a round or oval shape, and sometimes notched on their inner side, to give place for the insertion of the antennæ. In a few instances they are placed at the end of foot-stalks made by a lateral prolongation of the head.

The *Trophi*, or parts of the mouth.—The mouths of insects present two strongly marked variations, one of which is fitted for gnawing solid substances, and is called the *mandibulate*, or gnawing mouth; and the other is fitted for sucking fluid nutriment, and is called the *haustellate*, or suctorial mouth.

The mandibulate mouth is composed of six pieces, more or less distinct, and their appendages. First, the *labrum*, or upper lip: a horny, usually somewhat semi-circular plate, attached to the anterior and inferior edge of the head, and serving to close and protect the mouth in front.

Then, the *Mandibles*, or upper jaws; a pair of very hard, horny pieces, more or less hooked at the point, and often toothed on their inner sides, which work together laterally, somewhat like the blades of a pair of scissors. These are the true biting, gnawing, or masticating organs.

Next are the *Maxillæ*, or lower jaws; a pair of organs, working laterally like the mandibles, but softer and more pliable in their texture, generally divided into two lobes at their extremity, which are furnished more or less with hairs. The maxillæ undoubtedly assist in the operation of eating, but the precise part which they perform is not well understood.

Behind the maxillæ is a single piece which partially closes the mouth behind, and which may therefore be considered as the counterpart of the labrum or upper lip, and is accordingly called the *labium*, or lower lip,

In the Coleoptera this piece is usually attached at its base to the anterior face of an elevated ridge upon the under side of the head, which forms a kind of wall behind the mouth, usually deeply notched in the middle, and which is called the *mentum*, or chin.

When the labium forms a narrow elongated piece, distinct from the mentum, as in most of the Coleoptera, it is now generally called the tongue, *lingua* or *ligula*.

The *Palpi*, or appendages of the mouth.—Near the base of each maxilla, on its outer side, is attached a movable appendage, usually composed of four or five joints, and never more than six, called the *maxillary palpus;* and near the base of the labium is attached a similar pair of organs, but with a less number of joints, distinguished as the *labial palpi*. These appendages are subject to considerable variation especially in the shape of their terminal joints, and are made much use of in determining the families and genera of insects.

The *haustellate* or *suctorial* mouth consists of a more or less elongated proboscis or sucker, which is sometimes short and fleshy, as in the flies, (*Muscidæ;*) sometimes more elongate, horny and pointed, as in the bugs, (*Hemiptera;*) and sometimes very long and slender, and rolled up, when not in use, in a spiral coil, as in the butterflies and moths, (*Lepidoptera.*)

It is evident that all insects with a suctorial mouth must live exclusively upon liquid food, or the juices of animals and plants.

The *haustellum* or sucker is not a single organ, as it appears, but has upon its upper side a deep groove, in which are contained usually either two or four, but in some of the carnivorous species (mosquitoes and horse-flies) six needle shaped pieces, which in these last make a complicated weapon with which they pierce the skins of animals upon whose blood they subsist.

From a comparison of the haustellate with the mandibulate mouth, in different kinds of insects, it has been concluded that the apparent sucker, which, as we have just seen, forms a sheath for the smaller needle-shaped pieces, corresponds to the labium, and that the contained pieces must represent the mandibles and maxillæ, and, where six pieces are present, also the labrum and lingua. In accordance with the proportionately great development of the labium, we find that its appendages, that is, the labial palpi, are also very prominent, whilst the maxillary palpi are very small or rudimental. This is the case in two of the suctorial orders, the Lepidoptera and Diptera; but the other order (Hemiptera) is exceptional in this respect, having neither maxillary nor labial palpi developed.

THE THORAX AND ITS APPENDAGES.

The thorax is the second, or middle division of the bodies of insects. Though apparently single, it is really composed of three pieces soldered together. These pieces are more distinct in some insects than in others, but they can always be distinguished by impressed lines upon the surface called *sutures*. The three pieces of the thorax are distinguished as the fore-thorax, the middle-thorax, and the hind thorax; or, in scientific language, the *pro-thorax*, the *meso-thorax*, and the *meta-thorax*. In the Coleoptera the pro-thorax is very large, and forms the large upper part, or shield, to which we usually give the general name of thorax. In this order of insects, the meta-thorax is invisible above, and the only part of the meso-thorax seen from above is the triangular piece between the bases of the elytra, called the *scutellum*.

In many insects (*Hymenoptera* and *Lepidoptera*) the pro-thorax is much reduced in size, and forms only a narrow rim, which is usually called the *collar*.

The under side of the thorax is called the *sternum* or breast plate. Each of the three divisions of the thorax has its sternum, designated respectively as the *pro-*, *meso-* and *meta-sternum*. In many insects, and especially the Coleoptera, each section of the sternum is divided by sutures into a middle piece or *sternum* proper, and a side piece, called the *episternum*. These parts will be described more particularly in treating of the Coleoptera.

The *appendages* of the thorax are the organs of motion, namely, the *wings* and the *legs*.

The *Wings*.—The great majority of insects have four wings. The anterior pair are attached to the upper part of the meso-thorax, and the posterior pair to the meta-thorax.

The wings are thin, membraneous, transparent organs, in some cases folded when at rest, and supported by ribs or veins running across them. These veins are found to correspond in their number and complexity to the rank of the insect in the scale, and from the ease with which they can be seen, they furnish admirable characters for the purposes of classification. In some insects, such as the grass-hoppers, the fore-wings are thicker and less transparent than the hinder pair, and have nearly the consistency of parchment; and in one large order of insects, the Coleoptera or beetles, the fore-wings become converted into the hard opaque pieces, known as the *elytra* or wing-cases. The elytra take no part in flight, but serve only to cover and protect the hinder or true wings, which are folded under them when at rest.

In one large order, the insects have but two wings, and are named from this character *Diptera*, or two-winged insects. In these insects the place of the hind-wings is supplied by a pair of little knobbed appendages called *halteres* or poisers.

There are a few exceptional cases of two-winged insects in some of the other orders—for example, some of the smaller Day-flies (*Ephemera*) in the order of Neuroptera, and the males of the Bark-lice (*Coccidæ*) in the order of Homoptera.

The Legs.—Insects have six legs, attached in pairs to the under side of each of the three segments of the thorax. The leg consists of four principal parts; the hip (*coxa*), a short piece by which the leg is attached to the body; then an elongated piece called the thigh (*femur*, plural *femora*); then another elongated piece called the shank (*tibia*); and lastly the foot (or *tarsus*), which is composed of a number of smaller pieces or joints; of which five is the largest and most common number.

The feet of insects terminate, almost invariably, in a pair of sharp horny claws (*ungues*); and between these, at their base, is often one or two little pads (*plantulæ*) by means of which flies and many other insects adhere to glass, or any other surface which is too smooth and hard for the claws to catch upon. The Lepidoptera have but one plantula, and the Diptera have two. Besides the parts of the leg here enumerated, there is a small piece attached to the hind part of the hip, called the *trochanter*. This is usually small and inconspicuous, but in the hind legs of the ground-beetles (*Carabidæ*) it forms a large egg-shaped appendage, which is one of the most characteristic features of this family of insects.

THE ABDOMEN, AND ITS APPENDAGES.

The abdomen is the hindermost of the three divisions of an insect's body. It is sometimes attached to the thorax by the whole width of its base, in which case it is called *sessile*. But it is often attached by a slender petiole or foot-stalk, when it is said to be *petiolated*. The abdomen is composed of a number of rings, one behind another, each ring usually lapping a little upon the one following it. The normal number of rings or segments of the abdomen is considered to be nine, and this number is actually present in the Earwig (*Forficula*) and a few other insects; but in the great majority of insects, several of the terminal segments are abortive, and only from five to seven can usually be counted.

In the females of many kinds of insects the abdomen terminates in a tubular, tail-like process, through which the eggs are conducted to their place of deposit, and which is therefore called the *ovipositor*. In some insects the ovipositor is simple, short, straight and stiff, as in some of the Capricorn beetles; but in others, as the Ichneumon flies, it is long, slender and flexible, and composed of three thread-like pieces, which when not in use, are separated from each other, giving these insects the appearance of being three-tailed.

CAPTURING AND PRESERVING INSECTS.

Insects which do not readily fly, such as the beetles and the bugs proper (*Hemiptera*), can be captured with the fingers, and are easily killed and also preserved, for the time being, by dropping them into alcohol. For this purpose every collector should have in his pocket one or more small, strong, wide-mouthed bottles, securely corked, and filled about two-thirds full with alcohol. The common morphine bottles answer this purpose very well. The quinine bottle can be used when a larger bottle is required. The insects can be left in the alcohol till the collector has leisure to pin them. They can be taken from the bottle with a pair of forceps, or the alcohol can be turned off into another bottle, and the insects shaken out on to a newspaper, or what is better, a sheet of blotting paper, which readily absorbs the moisture.

Insects which readily take flight, must be captured in a net, which is made like a small dip-net for fishes, by making a hoop of stout wire about ten inches in diameter, with the ends of the wire turned out so as to form a short handle three or four inches long, and this can be lengthened by inserting the ends of the wire into a wooden handle about two feet long. The net is made of lace or tarleton muslin, and should be twenty inches or more in depth.

Many species which would otherwise escape notice, can be obtained by beating the branches of trees, especially forest trees, and catching the insects as they fall. A common umbrella, inverted under the tree, answers this purpose very well. This is in many ways a very useful implement to the collector. It will serve to protect him from the direct rays of the sun, or from a casual shower; and the hook at the end of the handle will enable him to draw down branches so that they can be satisfactorily examined. The umbrella would be improved by being covered with white cloth, upon which small insects would be more easily detected.

Most insects except those above mentioned are injured by being immersed in alcohol, and butterflies and moths would be ruined by it. These insects can be killed by wetting them with benzine or chloroform. The benzine is the cheaper, and the only objection to it is its disagreeable odor. Large insects require to be saturated with chloroform several times to destroy life. A very neat way to kill the smaller moths is to put them under a wine-glass and put in with them a tuft of wool saturated with chloroform. The moths are killed by the fumes, without being wet or handled. Some use for this purpose a poisonous preparation called cyanide of potassium.

In mounting beetles the pin should be passed through the right wing-cover; other insects are pinned through the thorax. The pin should be inserted so far that half of it will project below the body of the insect.

The value of a collection of insects is greatly enhanced by having the legs and wings of the specimens displayed in a life-like attitude. For this purpose they must be set out with pins, and held so a day or two till they have become fixed. For spreading the wings of butterflies and moths it is indispensable to have a simple apparatus called the *stretcher*. It consists of two strips of nicely dressed soft pine wood, 18 or 20 inches long, two inches wide, and about three-eighths of an inch thick, placed side by side, half an inch apart at one end and a quarter of an inch at the other, so as to accommodate insects of different sizes, and held so by a cleet across each end. The space between the strips must be closed on the underside by pieces of sheet cork tacked to the board. The space between the strips is to receive the body of the insect, the pin being passed through the cork so as to bring the wings on a level with the upper side of the stretcher. The wings are spread by catching them just behind the stout front rib with a pin, or, what is better, a needle set into a little handle, and carrying them forward, till the hind margin of the fore-wings are on a straight line with each other. They can be held in this position either by strips of card laid across them and fastened with pins, or by inserting a single small pin through the wing, behind the rib, and into the side pieces of the stretcher, which on this account should be made of the softest kind of wood. For very small moths the stretcher must be constructed upon a smaller scale.

Insects must be allowed to dry thoroughly before inclosing them in the cabinet. Beetles which have been permitted to dry with their limbs contracted, can be relaxed by putting them into hot water.

Boxes for the permanent preservation of insects may be 17 or 18 inches square, two and a half inches deep, outside measurement, and one inch and a half or a trifle more in the clear, made of perfectly seasoned wood, halved together in the middle, so as to have an upper and lower part, the former serving as the cover. The lower part must be lined on the bottom with sheet cork or thin strips of corn-stalk, and the whole covered with soft white paper. The paste with which the paper is attached should have a portion of arsenic stirred in with it, to guard against destructive vermin. The upper part, or cover, should be cut in around the top, like a window sash, so as to receive a plate of glass, which is to be secured in the usual way with putty.

Every insect drawer should have a lump of gum camphor rolled in a piece of muslin and pinned into one corner, to keep out destructive vermin. The presence of vermin is detected by little heaps of the dust-like gnawings under the infested specimens. Such specimens should be at once removed, and if the drawer is much infested, a teaspoonful or two of benzine should be poured upon the bottom, and the drawer or box immediately closed, so as to retain the fumes.

MAGNIFYING GLASSES.

A magnifying glass consisting of one, or, what is better, two lenses, so arranged that they can be used either singly or combined, is absolutely indispensable in studying insects. This simple instrument, the usual cost of which is one dollar per lens, is all that is usually required. It is a common mistake to suppose that insects cannot be studied and classified without the use of a complex and costly microscope. Such instruments are useful only to examine excessively minute or transparent objects, and though sometimes indispensable to the professional entomologist, they are rarely used in the ordinary study of insects.

THE INSTINCT OF INSECTS.

Instinct is that faculty by which animals are enabled to discover their food, construct their nests, and provide for their young, and to perform these operations without having had any previous education or experience. Many of the manifestations of this faculty are truly wonderful and unaccountable. Such are the mathematically accurate construction of the cells of the honey-comb; the curious economy of the ants and bees; and the provisions which many kinds of insects make for the future subsistence of their young, even in advance of their existence.

Instinct is often spoken of as an imperfect or partially developed reason, but its relation to that faculty can be, at most, only that of a very remote analogy. It differs from reason in its invariableness and its almost absolute infallibility, but most essentially in its independency of previous knowledge and experience. Reason acts only by virtue of what is already known, and man, who vastly excells all other animals in his reasoning powers, approaches perfection in any complex work only by long study and practice; the honey bee, on the contrary, constructs its first cell with such mathematical accuracy that it cannot be improved by any subsequent experience.

Some of the higher animals, such as the horse and the dog, give proof of the possession of a reasoning faculty similar to our own, and inferior only in degree. But whilst the manifestations of reason are fainter as we descend in the animal scale, instinct becomes more remarkable, and in insects especially, in which reason is almost if not absolutely wanting, instinct is exhibited in its highest perfection, far surpassing, in many instances, in accuracy and prescience, the reason of man himself.

Of the nature of the instinct of animals, as of that of the human mind, we know absolutely nothing; and we can only confess our ignorance by referring its wonderful manifestations to the direct agency of the Creator.

INSECTS FROM A PRACTICAL OR ECONOMIC POINT OF VIEW.

In regarding insects from this point of view, we have to consider them in both their beneficial and their injurious relations. The directly beneficial insects are almost limited to the three well-known species: the honey-bee, the silk-worm and the cochineal-insect; whereas, those species which are injurious to mankind, chiefly by depredating upon valuable cultivated crops, are much more numerous, although constituting but a very small proportion of the whole insect world. It is important to bear in mind that in these destructive operations insects occupy an exceptional or abnormal position, and that we ourselves have been the means of bringing about this state of things, by the excessive cultivation of certain plants, whereby a corresponding increase of certain species of the insects which feed upon them has been induced. It is very rarely that any such loss of balance between the insect and the vegetable worlds takes place in the state of nature; and yet, such occurrences are not wholly unknown. This has happened most remarkably in the case of wood-eating insects, there being instances on record in which extensive tracts of forest trees have been destroyed by the larvæ of some of the more minute wood-boring beetles.

But, as just stated, it is in their depredations upon some one or other of the more valuable cultivated crops that insects have come into the most direct and serious conflict with human interest. These depredations, as is well known, have often been of a most extensive and ruinous character, causing the annual loss of crops to the value of many millions of dollars, and in some seasons and localities, necessitating the total abandonment of some of the most valuable and staple productions, such as wheat, barley and potatoes, and also some of our choicest fruits, such as the plum and the peach; and sometimes threatening the destruction even of the most valuable fruit of all—the hardy and widely distributed apple. These destructive operations of insects have necessarily attracted to them the most earnest attention of both practical and scientific men, and many valuable treatises and reports have been written which have been devoted chiefly to the practical treatment of the subject. It is our present intention to treat of insects from a more general and comprehensive point of view.

GENERAL UTILITY OF INSECTS.

From what has just been said, it is evident that it is in the nature of their food and their food-taking habits, that insects hold the closest relationship to human interests; and this is true not only in the direct manner above described, but also indirectly, by means of the important parts which they fulfill in the economy of nature. Indeed, the operations of insects in this last respect are of such vast importance, that it would be safe to say that if these should cease, the earth would soon become uninhabitable by mankind. These operations consist chiefly, first, in the destruction of other insects by the predaceous and parasitic kinds, whereby the excessive increase of the former is held in check; secondly, in the instrumentality of a large proportion of insects in their character of scavengers, whereby the decomposition of decayed and offensive matters, both animal and vegetable, is effected and accelerated: and thirdly, in the agency of insects in causing the fertilization of plants, especially those with very deep corrollas, and those which have the barren and productive flowers upon different plants, by carrying upon their legs, in their search for honey, the fertilizing pollen from one flower to another. A long chapter might be written upon each of these topics, but we have space here barely to enumerate them.

DIVISION OF INSECTS ACCORDING TO THE NATURE OF THEIR FOOD.

From this point of view all insects may be divided into two classes—the carnivorous insects, or those which eat animal food, (*Sarcophaga*); and the herbivorous insects, or those which subsist upon vegetable substances, (*Phytophaga*). Each of these classes is again divisible accordingly as the insects which compose it take their food in a fresh and living state, or in a state of decay. The former are called predaceous insects (*Adephaga*), when they live upon animal prey; and the latter are designated by the name of scavengers (*Rypophaga*). Those insects which eat living animal food, are still further divisible into predaceous insects proper, which seize and devour their prey, and parasite insects, which live within the bodies of their victims and feed upon their substance.

Those insects which feed upon decaying animal matter present three divisions: first, general scavengers, which devour particles of putrescent matter wherever they may be found; second, those which live exclusively in or upon the bodies of dead animals, (*Necrophaga*); and thirdly, those which are found exclusively in animal excrement, (*Coprophaga*).

The herbivorous insects may be divided in a similar manner into those which eat fresh vegetable food, (*Thalerophaga*), and those which subsist upon vegetable matters in a state of decay, (*Saprophaga*). They can also be usefully classified according to the particular parts of the plant which they devour, into lignivorous or wood-eating insects, (*Xylophaga*); the folivorous, or leaf-eating insects, (*Phyllophaga*); and the fructivorous, or fruit-eating insects, (*Carpophaga*).

The above Greek terms in parenthesis have been used chiefly in connection with the insects of the Coleopterous order, in which these diversities of food-habits exist to a much greater extent than in any of the other orders, but the terms themselves are of general signification, and being very concise and comprehensive, they might, not improperly, be used in speaking of insects in all the orders, so far as they are applicable.

DIFFERENCE OF FOOD OF THE LARVA AND THE PERFECT INSECT.

In attempting to classify insects according to the nature of their food we meet with a peculiar difficulty, owing to the remarkable change which some species undergo in this respect, in passing from the larva to the perfect state. Most caterpillars, for example, feed upon leaves, whilst the butterflies and moths which they produce subsist upon the honey of flowers, or other liquid substances. Some two winged flies (*Asilidæ*) feed upon the roots of plants in their larva state, but become eminently predaceous in their winged state. Another remarkable example is furnished by certain coleopterous insects (*Meloidæ*), which are parasitic in their larva state, but subsist upon foliage after they have assumed the beetle form. The question therefore arises, to which stage of the insect's existence shall the precedence be given in this respect? At first view it would seem that the perfect state ought to govern, but when we take into account that insects are comparatively short lived in this state; that having arrived at maturity they require but little food; and that some insects take no food at all at this stage of their lives; whereas all the growth of an insect takes place whilst it is in the larva state, and consequently it is in this state that they feed so voraciously: when we consider this, it seems more reasonable that in classifying insects upon this basis, the food-habits of the larva should take the precedence.

In the following work I have not thought it best to adopt any inflexible rule in this matter, but have been governed by one or the other view accordingly as its importance might seem to preponderate in each particular case.

DISTINCTION BETWEEN NOXIOUS AND INJURIOUS INSECTS.

The terms noxious and injurious are often used indiscriminately, but strictly speaking, noxious insects are those which are endowed with some poisonous or otherwise hurtful quality; and these are divisible into two classes accordingly as they are hurtful to mankind directly, such as the mosquito, flea, and bed-bug; or are hurtful to the domesticated animals, as the horse-fly, the bot-fly, and the various kinds of animal lice. The insects which attack man directly are annoying rather than seriously hurtful, and this is usually the case also with those which molest the domesticated animals; but these sometimes multiply so as to seriously impoverish the animals which they infest.

The term *injurious*, as distinguished from *noxious*, is properly applied to all those insects which damage mankind indirectly, but often to a most serious extent, by depredating upon those crops upon which we depend for subsistence and profit.

NUMBER MORE IMPORTANT THAN SIZE.

It is worthy of remark that by far the greater proportion of the damage caused by injurious insects is effected by species of very small size, whilst the large species are generally harmless. The two most serious fruit insects, the Codling-moth and the Plum-curculio, are both below the medium size, and the Apple bark-louse, the Apple-aphis, the Hessian-fly, and the Wheat-midge, are so minute that they would not be noticeable were it not for the wide destruction which they cause to some of our most valuable crops, in consequence of their excessive multiplication.

TREATMENT OF INJURIOUS INSECTS.

For the details of treatment the reader is referred to the practical treatises and reports which have been published upon this subject. We can give here only an abstract of the methods to be pursued.

First, hand-picking and destruction by machinery, as in the case of the Colorado potato-beetle; second, poisoning by such substances as Paris-green, hellebore, and carbolic acid, as in the cases of the Potato beetle, and the Currant saw-fly; third, rendering their food distasteful and repugnant to them by the application of such substances as ashes, lime, and whale-oil soap, which are applicable to all foliage-eating insects; fourth, anticipating their attacks by planting at such times as will cause the crops to sprout or to mature too early or too late for them, both of which plans are exemplified by winter wheat, in its relation to the Chinch-bug and the Hessian-fly; and fifth, when all other means fail, preventing their ravages by abstaining for a year or two from raising the damaged crops. To these may be added, in certain favorable instances, the transportation and colonization of friendly parasites. An experiment of this kind has been performed by the author by the transportation from the central to the northern parts of the State of Illinois, of the minute Chalcis-fly, which is parasitic upon the Oyster-shell Bark-louse.

The above list exhibits the most common methods of contending with injurious insects, and these methods admit of almost indefinite modification. But they can be most usefully described in connection with the particular species of insect to which they are respectively applicable.

USE OF LEARNED AND SCIENTIFIC TERMS.

With regard to the use of scientific terms, derived mostly from the Greek and Latin languages, it is to be remarked that though they may appear difficult and forbidding, at first sight, the student soon becomes familiarized with them, and finds them to be almost indispensable by enabling him often to express in one or two words what would require a whole sentence in English. It is also an important consideration that in learning the elements of any science or art, an indispensable part of such education is to acquire a knowledge of the more common technical terms which properly belong to it, and which constitute its peculiar phraseology, and which the student will continually meet with in all writings upon the subject. In a work intended, like the present, for the common student, all unnecessary use of such words should, of course, be avoided, and whenever we have found it necessary to use them, we have taken care, as a general rule, to explain their meaning, either directly or by the nature of the context.

The student must not expect that any science can be so simplified as to remove all difficulties; and especially true is this of so extensive and complex a science as entomology. Nor is it desirable that this should be done. One of the principal advantages to be expected from the study of this science is the admirable mental discipline which it affords. The forms with which it has to deal are so numerous and diversified, and often, at the same time, so closely allied, that their classification constantly demands a minute and careful examination, and a discriminative analysis, which, regarded purely as an exercise of the mind, are scarcely inferior to those required by the abstract mathematics, whilst they possess the additional interest which naturally attaches to the study of living beings.

CLASSIFICATION AND NOMENCLATURE.

Classification in natural history has two objects in view—first, to show the relationship which exists between organized beings, by putting them in groups in accordance with the similarity of their characters; and secondly, to facilitate the study of them by enabling the student to comprehend a great number of different but allied forms under a comparatively small number of general heads, and thus to afford an important aid to the memory.

By nomenclature is meant the giving to these groups and the species which compose them distinctive names. This is necessary to enable us either to receive or to communicate knowledge; and without it natural history could not be raised to the dignity of a science.

In a department so extensive as that of insects a very great number of names, not only of species, but of the groups in which these are comprehended, must be necessarily introduced. It is therefore important that the science shall not be encumbered by the creation of unnecessary genera, or such as are founded upon slight and unimportant characters. It is, indeed, often difficult to determine precisely what characters or combination of characters necessitate or justify the formation of a new genus, or the subdivision of an old one. No definition of the term *genus* which is universally applicable ever has been, or perhaps ever can be given, inasmuch as the characters which constitute it often possess very different values in the different genera and families, not only of insects, but of animals generally, and therefore the formation of genera must necessarily be left to the judgment of the author.

It is the natural tendency of the specialist to attach undue value to the minor subdivisions of his particular department, whilst he whose studies take a wider range sees more forcibly the necessity of condensation and simplification. Much can be said upon both sides of this question, but perhaps the argument may be condensed into a single sentence by saying that, on the one hand, the minute subdivision of a natural group tends to give definiteness and precision to our investigations, whilst, on the other hand, the multiplication of genera or sub-genera, upon trivial characters, unnecessarily encumbers our nomenclature, and diminishes the interest and importance which ought to attach to the generic distinction.

In writing the names of insects—and the same rule applies to all other departments of natural history—it is the established custom to write first the name of the genus, usually without the author's name attached, and immediately following it the specific name, with the name of the original describer, or an abbreviation of it, appended. As no one can carry all the modern genera of insects in his memory, it is an excellent practice, when space permits, to prefix the name of the older and more comprehensive genus to which such species was formerly referred, and with which most entomologists may be presumed to be familiar. In this case the modern genus is included in a parenthesis, and usually with the author's name attached.

To illustrate by examples: The common rose-slug is the larva of a little wasp-like insect, known scientifically as the *Selandria rosæ* of Harris. This species was first described by Dr. Harris, who gave to it the specific name *rosæ*, meaning *of the rose*. It belongs to the modern genus *Selandria*, which was founded by Dr. Leach, an English entomologist. This genus is a subdivision of the old genus *Tenthredo*, of Linnæus. The name written in full, therefore, will stand:

Tenthredo (Selandria, Leach*) rosæ*, Harris.

Our fine large Polyphemus moth was originally described by Linnæus under the name of *Attacus Polyphemus*. It belongs to the modern genus Telea, made by the German lepidopterist, Hübner. Its name, therefore, expressed in the simplest manner, is *Telea Polyphemus*, Linn.; or written in full—

Attacus (Telea, Hübner*) Polyphemus*, Linnæus.

This is ordinarily all that is essential to be known, and any additional synonyms or references should be placed in a subordinate position.

. It will be observed that all the family names of insects end in *idæ*. This is a Greek termination, meaning *like* or *similar*, and implies that all the species in any such group have a family resemblance to those of the leading genus to which it is affixed—thus: *Cicindelidæ* means *Cicindela like* insects. In pronouncing these words the accent is placed upon the syllable preceding this termination, thus: *Cicindel-idæ*, *Carab-idæ*, etc.

It is often the case that families, especially those which contain many species, admit of division into a number of natural groups of a higher rank than genera, which are designated as sub-families, and distinguished by the termination *ides*. Thus the family Caribidae is divided into a number of sub-families, such as the *Brachinides*, the *Scaritides*, etc.

DIVISION OF INSECTS INTO ORDERS.

The class of insects is divided into a number of primary groups called *orders*. Between these larger divisions are certain smaller ones, which serve as connecting links between them, and which some authors have merged in one or the other of the adjoining larger groups, whilst others have considered them of sufficient importance to be raised to the same rank with the larger ones. From this it has resulted that the number of orders into which the class of insects has been divided has varied, even in the works of standard authors, from seven to twelve, and the number will be still increased if we regard as distinct orders certain apterous form, such as the lice *(Pediculi,)* and the springtails *(Thysanura.)*

But as in this elementary treatise it is the intention to simplify the classification of insects as much as possible, we have adopted the smaller number of orders, with the single exception of recognizing the division of the Hemiptera into Homoptera and Heteroptera as of ordinal value.

The orders of insects are founded primarily upon the number and structure of the wings. This mode of division was first suggested by Aristotle, who gave the names which they now bear to two of the orders, namely, the Coleoptera and the Diptera. It was afterwards almost perfected by Linnaeus, but has been somewhat modified by more recent authors.

The orders, at the present time, are usually arranged in two sections, with four orders in each, based upon the form and structure of the mouth.

TABLE OF THE ORDERS OF INSECTS.

Section 1st. *Mandibulata*, or *Gnawing Insects.*—Mouth composed of jaws and mandibles.

A. Upper wings of a horny or leathery consistency; under wings membraneous.

  B. Upper wings horny, and usually inflexible; under wings folded both lengthwise and crosswise; inactive in the pupa state: Coleoptera.

  B B. Upper wings coriaceous, or like parchment; under wings folded lengthwise only; active in all their stages: Orthoptera.

A A. All four wings membraneous and transparent.

  C. Wings with many branching veins, and usually many cross-veins; abdomen without an ovipositor....Neuroptera.

  C C. Wings with comparatively few veins; abdomen of the females terminating in an ovipositor or a sting: Hymenoptera.

Section 2d. *Haustellata*, or *Sucking Insects.*—The mouth consolidated into a proboscis or sucker.

A. Wings four.

  B. Wings covered with bran-like scales..........Lepidoptera.

  B B. Wings naked.

    C. Upper wings of the same texture throughout, not lapping over each other, deflexed or roof-shaped when at rest: Homoptera.

    C C. Upper wings coriaceous at base, membraneous at tip, lapping one over the other at the tip, and lying flat upon the abdomen when at rest.............Heteroptera.

A A. Wings two, membraneous..........................Diptera.

Order of COLEOPTERA.

The Coleoptera, (a term composed of two Greek words, *κολεος a sheath*, and *πτερα wings*,) commonly called *beetles*, are the most numerous division of the mandibulate or gnawing insects. They are distinguished from all other insects by the hard texture of their bodies, and by their horny wing-covers, called *elytra*, which represent the upper pair of wings of other insects. The elytra are not moved in flight, but only raised so as to permit the free motion of the lower or true wings, and a few of the chafers *(Cetoniæ)* do not even raise them during flight. They are generally hard, horny and inflexible, but in the lightning-beetles *(Lampyridæ)* and a few others, they are comparatively thin and flexible, but never membraneous like the lower wings. The inferior or true wings differ from those of almost all other insects in being folded crosswise, as well as lengthwise, when at rest under their cases. The Buprestidæ and a few others form exceptions to this rule. A few kinds which live under stones and in other dark places, and which have no occasion to fly, have no wings under their elytra.

Owing to the perfect development and the hard texture of the crust or integument of the Coleoptera, and also to the circumstance that it is not usually much obscured by hair, this part is made more use of in classification than it is in any of the other orders. The upper side exhibits the three divisions of the insect's body: the head, the thorax, and the abdomen, covered by the elytra. Between the elytra, at their base, or where they join the thorax, is almost always a small triangular piece called the *scutellum*. On the under side, each of the principal parts is seen to be composed of a considerable number of pieces usually soldered together, and distinguished only by fine impressed lines called *sutures*. These subdivisions and their names will be sufficiently understood, without the necessity of a detailed description, by the annexed figure of one of the ground-beetles *(Harpalus caliginosus)* and the accompanying explanation, taken in connection with the general description in the beginning of the work.

EXPLANATION OF THE FOLLOWING FIGURE.

The oblong narrow piece in the middle of the mouth, marked L, is the *ligula* or tongue. At the extremity of the ligula are two little wings or side pieces marked *p p;* these are the *paraglossæ*. The other parts of the mouth are named in the figure, and have been described in the introductory part of this work. The under side of the head, behind the mentum or chin, is called the *gula* or *throat*.

The under side of the thorax is divided into a considerable number of pieces more or less distinct, and separated from each other by impressed lines called *sutures*. The middle portion is called the *sternum*

[Fig. 3.]

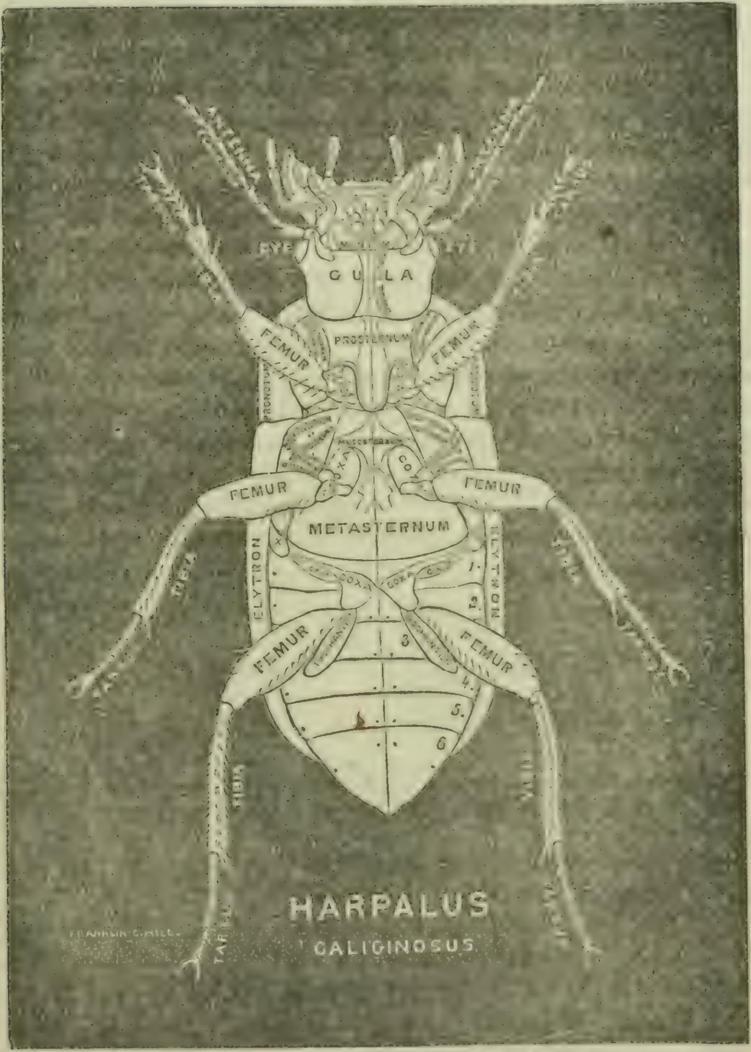
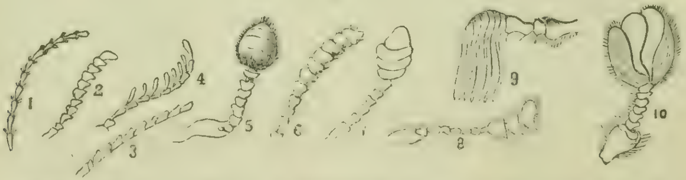


Diagram illustrating the structural parts of a beetle.

or breast-plate, and is divided into three parts, the *prosternum* or fore breast-plate; the *mesosternum* or middle breast-plate; and the *metasternum* or hind breast-plate. Each of these parts has a side piece, called the *episternum;* so that there is an episternum of the prothorax; an episternum of the mesothorax; and an episternum of the metathorax; all of which are labeled in the figure. Directly behind each episternum is a smaller piece called the *epimeron.* These are indicated in the figure by stars: three stars marking the epimeron of the prothorax; two stars the epimeron of the mesothorax; and one star the epimeron of the metathorax. The epimeron of the mesothorax is very narrow in Harpalus, and scarcely distinguishable without the aid of a lens; but in a part of the long-horned beetles (*Saperda*, etc.) and in some others, it is considerably wider, and affords valuable characters in classification. The *trochanters*, or little joints at the base of the thighs, are marked T R in the figure, except the large hind trochanters, where the name is printed in full. Behind the metasternum, and extending outwardly from the hind coxæ is a narrow piece marked CX. P. This is the *hind coxal plate.* This is a very narrow piece in Harpalus, but in some of the serricorn beetles (*Buprestidæ* and *Elateridæ*), it is much wider, and furnishes important generic characters, and in Haliplus, a genus of water beetles, it is excessively dilated. The other parts are sufficiently named in the figure.

The *antennæ* of the Coleoptera are usually eleven jointed and of moderate length, but they are subject to much variation both in length and form, as will appear in the descriptions of the different families. The subjoined figures show their most common variations, and the names by which they are designated. These forms have been more particularly described on a former page, when treating of insects in general.

[Fig. 4.]



ANTENNÆ OF COLEOPTERA.—1, filiform or thread-shaped; 2 and 3, serrate or saw-toothed; 4, pectinate or comb-toothed; 5, capitate or knobbed; 6, 7, 8, clavate or club-shaped; 9 and 10, lamellate or plated. —after LECONTE.

The *palpi*, or little jointed appendages to the mouth, also sometimes furnish important characters in classification. They vary chiefly in the shape of the terminal joint, which is sometimes much narrower than the others, when it is called *acicular* or needle-shaped, and sometimes much widened, so as to be in the form of a triangle or of a half-moon, or hatchet.

As the terms *large*, *small* and *medium-sized* are often used in speaking of insects, and as these words vary considerably in force, when used in different relations, we give below their average meaning when applied to the Coleoptera:

An inch or more in length, - - - -	Very large.
Three-quarters of an inch, - - - - -	Large.
Half an inch, - - - - - - -	Medium.
Quarter of an inch, - - - - - -	Small.
One-eighth of an inch or less, - - - -	Very small.

The intermediate sizes are expressed by such phrases as *rather large*, *rather small*, or *a little above*, or *a little below the medium*, etc. This standard applies only when speaking of any one group of beetles as compared with the Coleoptera generally. The same expressions will necessarily vary in force when applied to the species of a particular group as compared with each other, accordingly as the species of that group are large or small as compared with the rest of the order; that is to say, a small species of a group of generally large-sized insects may be larger than a large species of a small-sized group.

LARVÆ AND PUPÆ.

The *larvæ* of the Coleoptera are usually soft whitish grubs; naked, or with a few scattered hairs; with a mandibulate mouth not very unlike that of the perfect insects; usually furnished with six short feet and a single terminal proleg, but sometimes wholly footless. They live in secluded situations, sometimes in the ground, but oftener in the wood or under the bark of decaying trees, or in putrescent animal substances, and not unfrequently in nuts and seeds, and in the pulp of fruits. They are rarely found exposed to the light of day, and therefore they never exhibit the beauty of coloration, nor the variety of clothing which gives so much interest to the study of the caterpillars, which are the larvæ of the moths and butterflies. The larvæ of most of the families of Coleoptera are now pretty well known, but owing to the circumstances just mentioned, they have generally received but little attention from entomologists compared with that which has been bestowed upon the perfect insects. The larvæ of the several families will be more particularly described in their proper connections.

The *pupæ* are rarely inclosed in cocoons, but the larvæ, before changing, simply form cells by turning themselves round and round in the earth or rotten wood, in which they usually undergo their metamorphoses. But some larvæ, especially in the families of Curculionidæ and Chrysomelidæ, construct regular cocoons of web, not very unlike those of the nocturnal Lepidoptera, which they attach to the plants upon which they feed. The legs of the pupæ are always free, but they are not used, the insects being dormant and motionless during this stage of their existence.

THE COLEOPTERA FROM A PRACTICAL POINT OF VIEW.

In order to show more clearly the connection between scientific and practical entomology, in classifying the Coleoptera we have taken the food-habits of the several species as the basis of classification, it being in the nature of their food, and their methods of obtaining it, that insects come into the most important relationship to mankind, whether of an injurious or a beneficial character. We refer to the Coleoptera particularly, because they exhibit a much greater diversity of food-habits than any of the other orders of insects. Indeed this principle of classification is of value just in proportion as such diversity exists; and where it is very limited, as especially in the great order of Lepidoptera, it ceases to be available. Even in classifying the Coleoptera upon this basis, and at the same time paying the necessary respect to structural considerations, we are sometimes compelled to place insects of similar food-habits in several different, and sometimes remote, tribes. The wood-boring beetles, for example, constitute three distinct tribes, designated as the saw-horned borers *(Buprestidæ)*; the long-horned borers *(Cerambycidæ)*, and the short-horned borers *(Scolytidæ.)* There are likewise four distinct families of fungus-beetles, found respectively in each of the four tarsal sections. But notwithstanding such instances as these, the Coleoptera admit of a very interesting, useful, and, in the main, natural classification in accordance with the nature of their food.

As compared with the other orders of insects the Coleoptera are surpassed only by the Lepidoptera in the extent of their injuries to cultivated crops; and indeed they are so nearly equal to the latter in this respect, that there may be a doubt which takes the precedence; and it is true of either of these two orders, that, with the exception of the other, it includes a greater number of injurious species than all the other orders of insects combined. The great destructiveness of the Lepidoptera is readily explained by the nature of their food, nearly all their larvæ, commonly known as caterpillars, subsisting upon plant-food, and mostly in a fresh and growing state. The Coleoptera, on the contrary, embrace, in addition to the plant-eating species, extensive tribes of predacious and scavenger beetles, which are indirectly of incalculable benefit to mankind.

In studying the bearing of scientific upon practical entomology, nothing perhaps is more important than to trace the connection of the external structure of insects with their habits, and especially with the nature of their food; since we are thus enabled, to a certain extent, to determine the habits of an insect by simply observing the form and structure of its visible parts. We are able to lay down some general rules of this kind with respect to the Coleoptera, though most of them are subject to important exceptions. In order not to give too much space to this part of the subject, we will limit our observations to two of the most important and prominent organs—the antennæ, and the feet, or tarsi.

All predaceous beetles have filiform antennæ except the lady-birds or Coccinellidæ.

All the scavenger beetles have strongly clavate or knobbed antennæ, except the short-winged scavengers or Staphylinidæ, and these are only partial exceptions, as many of them are known to be predaceous.

All the leaf-eating beetles have filiform or nearly filiform antennæ, except the herbivorous Lamellicorns (*Rutelidæ* and *Melolonthidæ.*)

All fungus-eating beetles have the antennæ more or less strongly clavate.

The feet of the Coleoptera are of two principal kinds; first, *simple feet*, in which the joints are slender, and of about the same width throughout, and clothed only with somewhat scattered bristles; and secondly *bi-lobed feet*, in which the joints are somewhat widened and depressed, with the last joint but one usually a little wider than the others, and divided into two lobes, between which the last joint is inserted, and all of them clothed beneath with densely crowded short stiff hairs, of the same length, so as to resemble a brush; sometimes also compared to a piece of sponge.

As a general rule, beetles with simple feet reside upon the ground, or under the bark of dead trees, or in other decomposing matter, and are either carnivorous or rypophagous (filth eating) in their habits; and those which have bi-lobed and spongy feet live upon the foliage of trees and other plants, this structure of the feet seeming to be especially adapted to enabling them to adhere to the surface of leaves; and accordingly most of these insects are herbivorous.

But this general statement is subject to important exceptions. Some of the lamellicorn beetles (*Melolonthidæ*, *Rutelidæ*, etc.) have simple feet and yet feed upon the foliage of trees; but these insects do not run over the leaves, but simply cling to them with their sharp claws, whilst feeding.

So, also, some carnivorous beetles (*Telephoridæ* and *Coccinellidæ*), which pursue their prey over the foliage of trees, have their feet bi-lobed and spongy.

It is an interesting circumstance that those insects (*Melolonthidæ*, etc.) which only cling to the foliage by their claws, do not breed upon the trees, but pass their larval period under ground, subsisting upon roots or other subterranean matters, and only visit the trees for the sake of feeding; whereas the true Phytophaga, with spongy feet (*Chrysomelidæ* and their allies) live upon the plants upon which they feed, through all the active stages of their existence.

It is also a curious coincidence that the insects first mentioned, which only visit the trees occasionally for the purpose of feeding, do so only by night; whilst the genuine Phytophaga (plant eaters) are diurnal in their habits.

There is another partial but important exception to the rule above laid down, as respects the males of many carnivorous beetles, which have some of the joints of their anterior feet much widened and brushed underneath; but here the last joint but one is not bi-lobed, and the brush is usually confined to the anterior pair of feet, rarely extending to the middle pair, and never to the hind ones; besides being limited exclusively to the males.

Whilst some of the other orders of insects excel the Coleoptera in the perfection of their instincts, no other order can be compared with them in the diversity of their food, and their corresponding habits and organization. Indeed the Coleoptera combine, to a great extent, the food-habits of all the other orders. The herbivorous habits of the Orthoptera, the carnivorous habits of the Hemiptera, the aquatic habits of the Neuroptera, the honey-eating and the parasitic habits of the Hymenoptera, the leaf-eating habits of the larvæ of the Lepidoptera, and the putrivorous habits of the Diptera—all find their parallel in the ranks of the omnivorous Coleoptera.

CLASSIFICATION OF THE COLEOPTERA.

The Coleoptera are usually divided into four sections founded upon the number of joints in their tarsi, or feet.

These sections may be tabulated as follows:

Sec. 1.	Five joints in all the tarsi	*Pentamera.* 56
Sec. 2.	Five joints in the anterior and middle tarsi, and four joints in the hind tarsi	*Heteromera.*
Sec. 3.	Four joints in all the tarsi	*Tetramera.*
Sec. 4.	Three joints in all the tarsi	*Trimera.*

These terms, except the second, are composed of the Greek numerals meaning respectively, *five*, *four*, and *three*, prefixed to a word meaning *parts* or *pieces*. The prefix *hetero*, in the second section, means *different*.

As a general rule insects have five joints in their tarsi, and never more than five. This may, therefore, be regarded as the normal or typical number, and a smaller number must be taken as an indication of inferiority or degradation, using this word in its scientific sense. In accordance with this view, the most perfect and highly organized beetles are found in the pentamerous section; and in those which have less than five joints, there is usually a little swelling at the base of the last joint, which is supposed to be a vestige of the missing joint. This circumstance has led some authors to give more complex names to these sections, expressive of this character, but with the explanation here given we have preferred to retain the simpler nomenclature of Geoffroy and Latreille.

SUGGESTIONS TO AID IN CLASSIFYING THE COLEOPTERA.

The student will perceive that the primary division of Coleopterous insects is based upon the number of joints in their feet, or tarsi. This character, though apparently of trivial importance, is found to furnish an index to a more natural classification than can be established upon any other single character. In almost all beetles of considerable size, that is, more than a quarter of an inch in length, this character is very uniform, or, in other words, the number of tarsal joints in the insects of any one section or family, is remarkably unexceptional. It also has the advantage, in insects of this size, of being easily determined, if not by the naked eye, at least by the aid of a simple lens.

But the insects which are necessarily the most difficult to examine and classify are the very small ones, and here the character founded upon the number of tarsal joints not only becomes more difficult to determine, but more exceptional, and therefore of less value. We therefore give the following suggestions to aid the inexperienced student in cases of this kind.

The principal difficulty occurs with respect to numerous families containing very small species in the first or pentamerous section; and these are mostly limited to what are known as scavenger beetles, both the club-horned tribe, *(Clavicornes.)* and the short-winged tribe, *(Brachelytra.)* In the minute species of both of these tribes the number of tarsal joints is very irregular, one of them being often indistinct or wanting, especially in the posterior feet; and in three families at least, the Lathridiidæ, Trichopterygidæ and Pselaphidæ, two joints are wanting in all the feet, making them apparently but three-jointed.

The student will naturally inquire, why place these insects in the pentamerous section? The answer is, that they harmonize more closely with the insects of this section in their other characters, whilst they do not affiliate with the insects of the other sections which agree with them in the number of tarsal joints. An examination of their other characters will usually enable the student, after a little experience, to refer these insects to their true position; though cases sometimes occur which puzzle the most astute entomologist. They can hardly be confounded with the Heteromera, because these are, for the most part, much larger insects, and the exceptionally small species belong mostly to the tribe of Trachelides, which are distinguished from these and most other beetles by having the head attached to the thorax by a narrow neck. They differ from the Tetramera in the form of the tarsi and also that of the antennæ. Almost all these small species with deficient tarsal joints have these parts slender and simple, whilst all the genuine Tetramera have the tarsal joints somewhat widened and covered beneath with a dense brush of short hair, and the last joint but one is wider than the others, and divided into two lobes, between which the last joint is inserted. The only pentamerous beetles which have some of their tarsal joints obsolete, and at the same time have the last joint but one bilobed, are a part of the serricorn family of Cleridæ. Some of the short-winged scavengers (*Staphylinidæ*), with an irregular number of tarsal joints.

have a part of these joints widened but not bilobed in the males, but here it is a sexual distinction, and is confined to the anterior feet.

These small Pentamera, with variable tarsi, almost always have strongly clavate antennæ, except the Staphylinidæ, and these are distinguished at once by their short wing-covers. The true Tetramera, on the contrary, have the antennæ filiform, or at most slightly and gradually enlarged toward the tip, except the snout-beetles (*Curculionidæ*), and these are readily known by their elongated rostrum.

If, then, the student have in hand a small beetle whose place in the system he cannot determine with certainty, from the number of tarsal joints, let him first observe whether these joints are slender and simple or dilated and brush-like beneath, with the last joint but one deeply notched or bilobed; and then let him examine the antennæ, and observe whether they are slender and filiform, or whether they are decidedly enlarged at the end, either gradually (*clavate*), or abruptly (*capitate*).

1. *If the tarsi are simple and the antennæ filiform*, the species may belong to some one of a number of diverse families (*Carabidæ*, *Elateridæ*, *Mordellidæ*, *Melandryidæ*, *Cistelidæ*, and a few smaller families); but the beetles with this combination of characters are rarely of very small size, and they are, therefore, the more easily determined by their other characters.

2. *If the tarsi are simple and the antennæ clavate or capitate*, the insect may be referred, with very few exceptions, to some one of the families of scavenger beetles in the pentamerous section. This rule embraces a large proportion of very small-sized beetles, and will, therefore, be found of great use to the student in narrowing the field of his inquiry. A few apparent exceptions exist in the heteromerous families of Diaperidæ and Tenebrionidæ, but the former can be usually distinguished by their perfoliate antennæ, and the antennæ of the Tenebrionidæ are usually so slightly enlarged toward the tip as scarcely to be entitled to the name of clavate. Other partial exceptions are found in the family of Scolytidæ, or short horned wood-borers, all of which have strongly clavate antennæ, and some of which have simple tarsi; but many of them have the last joint but one slightly bilobed.

3. *If the tarsi are dilated and bilobed and the antennæ filiform*, the insect belongs to the family of long-horned borers (*Cerambycidæ*), or to that of the plant-beetles proper (*Chrysomelidæ*, etc.) The tarsi thus formed are almost always spongy on the under side. Only a few partial exceptions to this rule are found, and these are in the heteromerous families of Œdemeridæ, Anthicidæ, and a few others; but in these the tarsi are usually but slightly dilated, and but little, or not at all, spongy beneath.

4. *If the tarsi are dilated and bilobed and the antennæ clavate*, the species belongs to the tribe of snout-beetles (*Curculionidæ*), in the tetramerous section, or the family of Erotylidæ, or that of Coccinellidæ, in the trimerous section.

5. *Beetles with distinctly serrate antennæ* belong almost exclusively to the families of Serricornes proper, in the pentamerous section; but this rule also has a few exceptions. The pea and bean weevils (*Bruchidæ*), in the tetramerous section, usually have the antennæ decidedly serrate; and a few small families of the division of Trachelides, in the heteromerous section (*Rhipiphoridæ* and *Pyrochroidæ*), usually have the antennæ serrate in the females, and flabellate or branched in the males.

6. *All beetles with lamellate antennæ* belong to the division of Lamellicornes proper, in the pentamerous section. Only in very rare instances the branches of a pectinate or flabellate antennæ are somewhat flattened so as to resemble the true lamellate. An example of this is found in the little beetles of the genus Phlœotribus in the family of Scolytidæ.

Section 1. *PENTAMERA.*

Usually five joints in all the tarsi, one or two of them being sometimes deficient in very small species; all the joints usually slender and simple, except that the anterior, or anterior and middle tarsi are sometimes dilated and brush-like beneath, as a sexual distinction of the males.

It is seen by this formula that the pentamerous section is distinguished not only by the number, but also by the form and structure of the tarsal joints, the tarsi in this, and also in the succeeding or heteromerous section being, with but few exceptions, slender and simple, and clothed only with scattered hairs or bristles, whilst in the third and fourth sections the tarsi are widened and covered beneath with a dense brush of short hairs, or hair-like papillæ, and the penultimate, or last joint but one, is almost always bilobed. It is important to bear this two-fold distinction in mind, inasmuch as the form and structure of the tarsi often give the clue to the classification of small species in which the number of the joints is deficient or difficult to be determined. This has been already more fully explained in the general remarks on pages 30 to 34.

The ambiguity arising from the dilation of some of the tarsal joints in the males of certain species, can always be avoided by directing the examination to the hindermost tarsi, which are never so dilated.

This is the most numerous section, and comprises, as a general rule, the largest and most highly organized species in this order of insects, though it also contains many small species.

They can be divided into six sub-sections, founded upon their habits and the nature of their food, and distinguished primarily by the structure of their antennæ; and these sub-sections are again naturally divisible into a number of subordinate divisions or tribes. The following table gives a synopsis of the sub-sections, tribes, and families of the pentamerous beetles. The names given to these sub-sections are generally recognized, and in common use, except the first and the third. The term *filicornes*, though sufficiently characteristic of the predaceous beetles as compared with others of the pentamerous section, does not sharply distinguish them from some of the beetles of the other sections; and the term *monilicornes*, applied to the third sub-section—which is composed chiefly of the family of Staphylinidæ, though tolerably characteristic, especially of the larger and typical species—is not ordinarily applied to them, for the reason that the beetles of this division are more readily and strongly distinguished by another character, namely, the remarkable shortness of their wing-covers, expressed by the Greek term *brachelytra*, by which they are generally designated, or the corresponding Latin word *brevipennes*, which is sometimes, but less commonly used.

SYNOPSIS OF THE PENTAMEROUS COLEOPTERA.

SUB-SEC. I. *Filicornes.* Attennæ filiform. Habits predaceous.
  Tribe 1. Predaceous ground beetles. (*Carnivora terrestria.*) GEODEPHAGA, MacLeay.
    Families: Cicindelidæ; Carabidæ.
  Tribe 2. Predaceous water beetles. (*Carnivora aquatica.*) HYDRADEPHAGA, MacLeay.
    Families: Dytiscidæ; Gyrinidæ.

SUB-SEC. II. *Clavicornes.* Antennæ club-shaped. Habits mostly putrivorous.
  Tribe 3. Water scavanger-beetles. (*Putrivora aquatica.*) PHILHYDRIDA, MacLeay.
    Families: Parnidæ; Hydrophilidæ.
  Tribe 4. Land scavenger-beetles. (*Putrivora terrestria.*) NECROPHAGA partly, Latreille.
    Families: Silphidæ; Scaphidiidæ; Histeridæ; Nitudilidæ; Dermestidæ; Mycetophagidæ; Cryptophagidæ; Byrrhidæ; Anisotomidæ; Phalacridæ; Trichopterygidæ; Scydmenidæ; Trogositidæ; Cucujidæ; Colydiidæ; Lathridiidæ.

SUB SEC. III. *Monilicornes.* Antennæ more or less moniliform or bead-like; wing covers very short. Habits mostly putrivorous.
  Tribe 5. Short-winged scavengers. (*Putrivora brevipennata.*) BRACHELYTRA, Latreille.
    Families: Staphylinidæ; Pselaphidæ.

Sub-sec. IV. *Pectinicornes*. Antennæ pectinate or comb-toothed
- Tribe 6. Stag beetles.
  - Family: Lucanidæ.

Sub-sec. V. *Lamellicornes*. Antennæ lamellate. Food-habits different in the two tribes.
- Tribe 7. Lamellicorn dung-beetles. (*Excrementivora lamellicornia.*) SAPROPHAGA, MacLeay.
  - Families: Copridæ; Aphodiidæ; Geotrupidæ; Trogidæ.
- Tribe 8. Lamellicorn leaf-beetles. (*Herbivora lamellicornia.*) THALEROPHAGA, MacLeay.
  - Families: Dynastidæ; Rutelidæ; Melolonthidæ; Cetoniidæ.

Sub-sec. VI. *Serricornes*. Antennæ usually more or less serrate or saw-toothed. Food-habits various.
- Tribe 9. Saw-horned wood-beetles. (*Lignivora serricornia.*) STERNOXI, Latreille.
  - Families: Buprestidæ; Elateridæ; Cebrionidæ.
- Tribe 10. Aberrant wood-beetles. (*Lignivora aberrantia.*)
  - Families: Ptinidæ; Cupesidæ; Lymexylonidæ.
- Tribe 11. Soft-winged predaceous beetles. (*Carnivora mollipennata.*) MALACODERMI, Latreille.
  - Families: Lampyridæ; Melyridæ; Cleridæ.

First Sub-section, FILICORNES.

Antennæ filiform; palpi apparently six; habits predaceous.

Tribe I.

PREDACEOUS GROUND-BEETLES.

Carnivora terrestria. GEODEPHAGA,* MacLeay.

This extensive tribe of beetles is distinguished by their slender and filiform, or slightly tapering antennæ, in connection with their five-jointed tarsi or feet, all the joints always being distinct even in the smallest species; by having apparently six palpi; and by the prominence of their large egg-shaped posterior trochanters, which furnish a very distinctive and easily recognized character, and which no other coleopterous insects possess so conspicuously developed. (See Fig. 3, on page 27.) No insects have strictly more than four palpi, and the apparent additional pair which is peculiar to this and the following tribe, are really the outer lobes of the maxillæ which are here palpiform. They are almost exclusively carnivorous in their diet, and pre-eminently predaceous in their habits, both in the larva and the perfect states. They subsist chiefly upon the larvæ of other insects, and are therefore useful in helping to maintain a proper balance of insect life. As their name implies, they are found mostly on the ground. They run with great rapidity, and never attempt to seek safety by feigning death, as is the habit with many of the leaf and fruit-eating beetles.

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* From the Greek γῆ the earth, and αδηφάγος ravenous.

The tribe contains two families, distinguished as follows:

A. Head large and vertical, wider than the thorax;* antennæ inserted on the front; eyes large and prominent; mandibles strongly toothed; wing covers usually marked with yellow:

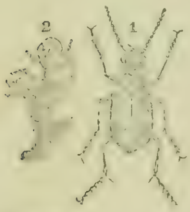
CICINDELIDÆ.

A A. Head horizontal or a little inclined, usually narrower than the thorax; antennæ inserted under the sides of the front; eyes moderate; mandibles simple or slightly toothed; color usually black; sometimes blue, green or brown; very rarely spotted:

CARABIDÆ.

Family I. CICINDELIDÆ, (Tiger-beetles.)

[Fig. 5.]



CICINDELA:—1, beetle; 2, larva—from Packard's *Guide*.

The Cicindelidæ are readily distinguished from all other pentamerous beetles, by their large vertical heads; that is, their heads are so set upon the thorax that when viewed from above, only the vertex or crown is distinctly seen, the face looking directly forwards. In a few large species which vary from the family type the head is not quite vertical, but yet strongly inclined downwards.

The common English name of Tiger-beetles expresses very well the character of these insects, and they may be said to represent in the insect tribes the tiger amongst quadrupeds, and the hawk and eagle amongst birds. They are the most highly organized and perfect of all coleopterous insects, and run and fly with equal facility. They are often seen running in hot dusty roads. When pursued they fly quickly, but usually alight again a rod or two in advance. About seventy species have been described as inhabiting the United States, including these found on the Pacific side of the continent.

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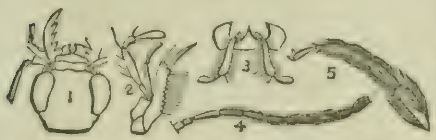
* That part of the body of a beetle which, when viewed from above, lies between the head and the base of the elytra, commonly called the thorax, is found upon dissection to be only the anterior section or pro-thorax, which is here greatly developed; all of the meso-thorax, except the little triangular piece called the scutellum, and the whole of the meta-thorax, being concealed under the basal portion of the elytra. Many recent writers have, therefore, adopted for this part the name of *pro-thorax*, which thus has the advantage of greater anatomical precision. The term *thorax*, on the other hand, has the claim of brevity and of long established usage, and this brief explanation will relieve it of any ambiguity that might otherwise be attached to it.

Their larvæ dig holes in the sand, often a foot or more in depth, at the mouth of which they lie in wait for their prey, dragging it, when captured, to the bottom of their burrows. The name of the principal genus, *Cicindela*, is derived from the Latin, *Candela*, a candle or taper, and was applied by the ancients to the glow-worm. The species are all of medium or rather large size, and are generally marked with yellow angular spots upon a dark green or purple ground. The Cicindela sexguttata of Fabricius, of a brilliant metallic green color, with two yellow dots at the side, and one at the end of each wing-cover, is one of our most beautiful beetles. It is often seen running over prostrate logs in the forest, in search, no doubt, for wood-eating larvæ.

[Fig. 6.]

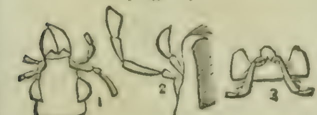


PARTS OF CICINDELA:—1, head; 2, maxilla; 3, mentum; 4, antenna; 5, anterior tarsus—after LeConte.

Family II. CARABIDÆ, (Ground-beetles.)

The leading characters of this family have been given in the description of the tribe to which it belongs. They are readily distinguished from the Cicindelidæ by the position of the head, it being directed forwards instead of downwards, so that the face and parts of the mouth are fully seen when viewed from above. The two families, however, closely approach each other in some of their species.

[Fig. 7.]



MOUTH PARTS OF CARABUS:—1, head; 2, maxilla; 3, mentum—after LeConte.

This is one of the most numerous families in the order of Coleoptera, eleven hundred distinct species having been already described as inhabiting North America alone. They are usually black, or of dark metallic colors, but are sometimes parti-colored. They are almost always found upon the ground, under stones, or in other obscure places. They never attempt to escape by flight, but run with great rapidity. Some of the smaller species, however, are seen flying in considerable numbers in the first warm days of spring, and a few are sometimes seen flying about our lights in summer evenings.

In view of the great numbers and predaceous habits of these insects, both in the larva and perfect states, it is evident that they must constitute a very important agency in holding in check the excessive multiplication of other insects. There are, however, a few exceptions to the almost universally carnivorous habits of this family. Species of the genera Omophron and Zabrus have been known to feed, even to an injurious extent, upon the soft grains of growing corn, and M. Zimmermann, in his memoir upon the genus Amara, states that the species subsist mostly upon succulent roots, and upon the pith and stems of grasses.

The larvæ are active grubs, of an elongated form, with sharp, projecting mandibles, and usually furnished at the hind extremity with a pair of conical, bristly appendages. They live in the same obscure situations as the parent insects, but are still more retiring, and are seldom seen. They are very intolerant of confinement, and however well cared for, they rarely live long enough to complete their transformations.

The Carabidæ constitute a very difficult study, on account of their great numbers and the general uniformity of their coloring; and what adds much to this difficulty is, that some of the most valuable characters used in their classification are peculiar to the male sex, and therefore afford us no aid, if the specimen in hand happens to be a female. Nothing but the familiarity which is the result of long experience in the study of these insects, can enable the student to recognize the slight modifications of form by which the minor divisions are characterized.

Authors have differed much in the principal divisions which they have made in this family, accordingly as they have assumed one or another class of characters to be of primary importance. Linnæus united all the species which he knew in the single genus *Carabus*. Fabricius, and others of the earlier authors, established many new genera, and Latreille combined and systematized them in the *Genera Crustaceorum et Insectorum*, and subsequently in the *Regne Animal*. This author divides the Carabidæ into seven sections, based upon the forms of the elytra, feet and palpi. Lacordaire, in his great work upon the *Genera des Coleopteres*, following the method of Erichson, divides the family primarily into two legions, founded upon the peculiarities of the tibiæ and of the epimera of the metathorax; and these legions he subsequently divides into ten sections, corresponding, in the main, with the sections of Latreille, with three additional ones, to receive certain anomalous forms. Dr. J. L. LeConte, the learned Coleopterist of our own country, originally divided these insects, in his Notes upon the classification of the Carabidæ, published in the tenth volume of the Transactions of the American Philosophical Society, 1853, into three sub-families, founded upon the number of abdominal segments and the form of the epimera of the mesothorax. In his later work upon the classification of the Coleoptera of N. America, (1860,) he abandons the number of abdominal segments as of primary value, and divides the family into three sub-families, based upon the form of the epimera of the mesothorax, and the relative position of the intermediate coxæ.

Selecting from all these sources the characters which seem to be best adapted to our purpose, we will divide the Carabidæ into six sub-families, as follows:

A. Epimera of the mesothorax wide and reaching the middle coxæ; epimera of the metathorax indistinct.

B. Anterior tibiæ quite or almost without notch on their inner side, and never toothed on the outer side, both of their spurs at or near the extremity: CARABIDES.

B B. Anterior tibiæ with a notch on the inner side, near the end, and toothed on the outer side; one of the spurs at the end and the other above the notch; abdomen pedunculated; size extremely various; color black: SCARITIDES.

A A. Epimera of the mesothorax narrow, and not reaching the middle coxæ; epimera of the metathorax distinct; anterior tibiæ always notched, with one spur at the apex and the other above the notch; abdomen sessile.

C. Elytra truncated at the extremity, leaving the tip of the abdomen exposed; thorax more or less heart-shaped, and much narrower than the abdomen; tarsi not at all or but slightly dilated; claws often pectinate; color usually blue, green, or variegated, rarely brown or blackish, never pure black..BRACHINIDES.

C C. Elytra entire, covering the whole of the abdomen; anterior tarsi of the males generally dilated; claws very rarely pectinate; colors various, mostly black.

D. Last joint of the palpi as wide, at least, as the others; size various, often small, but rarely very small.

E. Anterior tarsi of the males with the three first joints much widened, and covered beneath with a dense brush of hair-like papillæ; body often hairy or pubescent; colors usually green or blue-black, sometimes, but rarely, pure black ....CHLÆNIIDES.

E E. Anterior and frequently also the middle tarsi, with the four or three, or rarely two first joints dilated, and usually furnished beneath with two rows of scale-like papillæ, or more rarely with a brush of hairs; body usually smooth and shining; colors mostly black or metallic..................................HARPALIDES.

D D. Last joint of palpi very small; anterior tarsi of males usually with the first joint much dilated, and the second much less so, and scaly beneath; size small, usually very small..............BEMBIDIIDES.

The parts called *epimera*, made use of in the above table, will be understood by referring to Fig. 3, on page 27, where they are indicated by stars, as explained in the text. In section A, the epimeron of the mesothorax (indicated by two stars in the figure) is wide and somewhat triangular, and its inner extremity reaches the middle coxa, or rather forms a part of the wall or outline of the coxal cavity. But in section A A, (to which the species represented in the figure belongs) this epimeron is very narrow, and its inner extremity does not reach the coxal cavity, but impinges upon the anterior angle of the metasternum.*

It is not necessary, however, that the reader shall study out these parts. The several sub-families are sufficiently characterized without them. They are introduced here as probably indicating the natural relationship of the sub-families, and also because they form the basis of Dr. LeConte's classification of this family.

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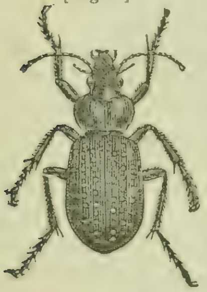
* This is best represented, but still imperfectly, on the right hand side of the figure. The inner extremity of the epimeron should have been represented as touching the metasternum, not at its apex, but a little behind it.

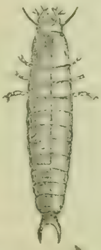
Sub-family CARABIDES.

[Fig. 8.]



CALOSOMA CALIDUM:—Beetle—after Riley.

[Fig. 9.]



CALOSOMA CALIDUM:—Larva—after Riley.

This sub-family contains nearly all the large species in the family, the principal exception being the genus Pasimachus, in the family of Scaritides. These large species, constituting the Carabides proper, are distinguished from all the rest of the family by the absence of the characteristic notch on the inner side of the anterior tibiæ, near the extremity, and by having the two tibial spurs situated at the apex. All the other Carabidæ have a conspicuous notch in this part, and one of the spurs is inserted above the notch. The anterior tarsi of the males are usually dilated, and spongy beneath. The palpi terminate in a large triangular joint, and this sub-family was therefore called, by Latreille, *Grandipalpi*. This division of the sub-family embraces the genera Carabus, Calosoma and Cychrus. The *Calosoma calidum*, a large black beetle, an inch in length, with three rows of golden dots upon each wing-cover, is one of the most common of the larger Carabides. This is the species illustrated at figs. 8 and 9.

But besides these large insects, a number of genera, composed of small and very different species, are usually included in this sub-family, in order to avoid a large number of primary divisions. This section contains the genera Elaphrus, Notiophilus and Omophron, all of which are usually found in wet situations. *Elaphrus ruscarius*, resembling a small Cicindela of an ashen bronze color, and with round pits upon the wing-covers, is often found in abundance running upon the wet sand along the margins of water-courses. Notiophilus is composed of small bronze-black species, not exceeding a quarter of an inch in length, and distinguished from the small species in the other sub-families by their large prominent eyes, giving to the head a width greater than that of the thorax. Omophron is an extremely anomalous genus, resembling a Coccinella or a Cassida much more than a Carabus. The species are rare in the northern States, but *Omophron labiatum* is common at the South, where its larvæ are said to depart from the ordinary carnivorous habits of the family, by feeding upon the grains of growing corn.

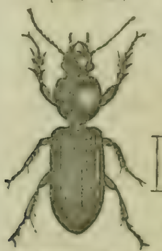
The most prominent characters of the leading N. A. genera are exhibited in the following table:

A. Body of the usual oblong form; meso-sternum and scutellum distinct.
B. Thorax with a sharp lateral margin; tibiæ without notch; last joint of palpi large and triangular; eyes moderate, size usually large.
C. Size large; elytra with numerous striæ.
D. Head of ordinary form; epipleura narrow. *
E. Third joint of the antennæ cylindrical; color mostly black................CARABUS, 11.
E E. Third joint of antennæ flattened; body with rich metallic tints........CALOSOMA, 21.
D D. Head narrow; epipleuræ very wide..CYCHRUS, 25.
C C. Size medium or below; elytral striæ not exceeding nine; color black..........NEBRIA, 18.
B B. Thorax without a sharp lateral margin; tibiæ with a small notch and with one of the spurs at a distance from the apex; last joint of palpi moderate; eyes very large; size small.
F. Thorax almost cylindrical, without salient margin, and much narrower than the abdomen; elytra with round shallow pits...........................ELAPHRUS, 10.
F F. Thorax depressed with an obtuse margin, nearly as wide as abdomen; color bronze black ....NOTIOPHILUS, 8.
A A. Body almost orbicular; mesosternum covered by the prosternum; scutellum wanting; colors variegated...... ....OMOPHRON, 9.

Sub-family SCARITIDES.

The most conspicuous character of this sub-family is the pedunculated abdomen, producing a separation between it and the thorax, whence this section was called *Bipartiti* by Latreille But the most essential and unexceptional character is the form of the anterior tibæ, which are widened and flattened, and toothed on the outer side, and with the outer angle prolonged into a long point. This structure enables these insects to dig in the earth, a habit expressed by the name of the typical genus *Scarites* of Fabricius, meaning a *scratcher*. The sub-family is also remarkable for the extreme disparity in the size of its species, Pasimachus being usually an inch or more in length, and Dyschirius less than an eighth. The anterior tarsi of the males are very rarely, and then but slightly dilated.

[Fig. 10.]



SCARITES (ASPIDOGLOSSA) ANGULATA. Chaudoir—aft. Riley.

A. First joint of antennæ elongated. Size comparatively large.
B. Thorax with the hind angles prominent. Size large, or very large. Elytra usually with a blue border ....PASIMACHUS, 14
B B. Thorax rounded behind. Size medium, or above...................................SCARITES, 3
A A. First joint of antennæ moderate. Size small, or very small.
C. Thorax somewhat square-shaped; abdomen elongate and depressed..............CLIVINA, 35
C C. Thorax sub-globose; abdomen ovoid..DYSCHIRIUS, 38

Pasimachus is an exclusively North American genus. The *P. marginatus* of Bonelli, and the *P. elongatus*, LeConte, are common insects, usually found under stones or old logs. Dr. LeConte has given some interesting details of the habits of the larva of *P. elongatus*, which digs a deep hole in the ground, resting with its head at the entrance, and springing upon any prey that may come within its reach, thus resembling in its habits the larvæ of Cicindela.

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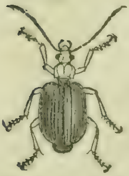
* The *epipleura* is the margin of the wing-cover which is bent abruptly downwards and covers the side of the abdomen.

Sub-family BRACHINIDES.

[Fig. 11.]



LEBIA GRANDIS, Hentz—after Riley.

This sub-family corresponds to the section of *Truncatipennes* of Latreille. The elytra are cut off at the extremity, either straight across, or obliquely, leaving the tip of the abdomen exposed. One of the most conspicuous general characters is the marked difference in size, and often also in color, between the thorax and the abdomen, the thorax being usually scarcely wider than the head. The beautiful pectinate claws at the end of the tarsi, so common in this sub-family, are not found outside of it in any of our Carabidæ, except the genus *Calathus*, in the sub-family of Harpalides. Other characters have been given in the tabular view of sub-families. Most of the species are extremely active. Some are found under stones, but those with pectinate claws are often seen upon plants and flowers, this structure of their feet probably enabling them to adhere to the hairs or down, or other inequalities upon the surface of the foliage.

The typical genus Brachinus (from the Greek *Βραχω*, *to resound*,) is remarkable for the faculty which the species have of discharging from the anus a pungent, volatile vapor, accompanied by an audible report, whence they have been denominated *bombardiers* by the French.

A. Antennæ filiform or setaceous. Abdomen more or less oval. Legs slender.

B. Thorax more or less heart-shaped, as wide as the head, and with a sharp lateral margin.

C. Antennæ setaceous, first joint as long as second and third united; the second nearly as long as the third. Form oblong; size rather large; thorax reddish, and elytra blue or black............GALERITA, 5 sp.

C C. Antennæ filiform, first joint moderate, second much shorter than the third.

D. Tarsal claws simple. Abdominal segments seven or eight. Color reddish yellow, with blue elytra............BRACHINUS, 38

D D. Tarsal claws pectinate. Abdominal segments six. Colors various.

E. Palpi slender. Thorax sub-orbicular or sub-quadrate.

F. Thorax roundish, wider than long; abdomen broad oval; colors usually bright and variegated............LEBIA, 32

F F. Thorax squarish, longer than wide; abdomen oblong-oval; color blackish: DROMIUS, 13

E E. Labial palpi ending in a widened hatchet-shaped joint. Thorax heart-shaped; abdomen oblong-oval.

G. Body glabrous. Colors brilliant............CALLEIDA, 11

G G. Body more or less hairy. Colors obscure............CYMINDIS, 23

B B. Thorax elongate and slender, much narrower than the head, and without a lateral margin. Claws simple.

H. Thorax spindle-shaped. Abdomen oval, convex, tarsi simple. Colors black and red............CASNONIA, 2

H H. Thorax nearly parallel; abdomen oblong, parallel, and depressed; penultimate joint of tarsi deeply bilobed. Elytra not truncated. Color brownish: LEPTOTRACHELUS, 1

A A. Antennæ robust, sub-moniliform, and somewhat widened and compressed towards the tip. Body elongated, parallel and depressed. Legs rather short and robust. Color brown: HELLUOMORPHA, 6

Galerita janus, Fab., is a fine and not uncommon species. The head is black; thorax and legs reddish-yellow, and elytra indigo-blue. *Brachinus fumans*, Fab., nearly half an inch in length, with indigo wing-covers, and all the other parts reddish-yellow; and several similar smaller species, which seem to pass insensibly into each other, are often found in colonies under stones in dry places. *Lebia* contains many prettily colored species, mostly a quarter of an inch or less in length. *Lebia grandis*, Hentz (Fig. 11), upwards of a third of an inch long, colored much like a Brachinus, is our largest species. This is one of the predacious insects which have been seen to devour the larvæ of the Colorado potato-beetle. The species of Lebia are sometimes found on low or herbaceous plants, and sometimes running up the trunks of trees in search for their minute insect prey.

The genera *Dromius*, meaning a *runner*, and *Calleida*, meaning *beautiful*, have similar habits. *Cymindis* is found under stones. *Casnonia pennsylvanica*, an elegant little insect, quarter of an inch long, and remarkable for its slender spindle-shaped thorax, is usually seen running upon the ground. The head and thorax are black, and the elytra red, with two black bands. It is not a very rare species.

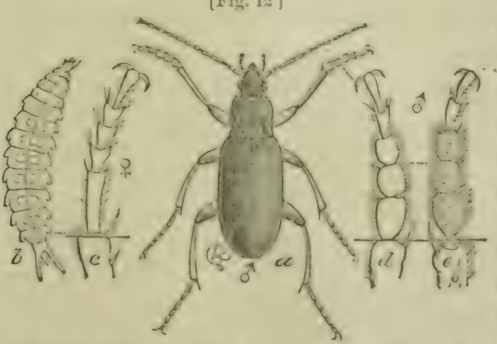
Leptotrachelus also, as its name implies, has a slender thorax, of about the same width throughout. This genus is usually classed in this sub-family, or near it, but it is exceptional in having the elytra entire and completely covering the abdomen.

Helluomorpha, of which we have several species, and the allied genus *Morio*, of which we have but one Southern species, differ from all our other Carabideous insects, in having the antennæ stout and almost bead-like, and either enlarged or strongly compressed toward the tip.

Sub-family CHLÆNIIDES.

The distinctive character of the Chlæniides consists in the structure of the anterior tarsi of the males, which have the three first joints widened, and furnished beneath with crowded points, or hair-like papillæ all of the same length so as to resemble a brush. These joints are usually more or less rounded at the corners, bearing a fanciful resemblance to the *patella* or *knee-pan*, which suggested to Latreille the name *Patellimani*, by which he designated this sub-family; *mani*, meaning *hands*, a term which is sometimes applied by entomologists to the fore-feet of beetles, because they are often constructed and used differently from the others. But

[Fig. 12]



CHLÆNIUS PENNSYLVANICUS, Say:—*a*, male beetle; *c*, front tarsus of female; *d*, front tarsus of male showing the widened and rounded or patelliform joints; *e*, underside of same, showing the brush-like surface—after Riley; *b*, larva of CHLÆNIUS—after Chapuis and Candèze.

apart from this sexual, and therefore often unavailable character, the Chlæniides can usually be distinguished from the Carabides proper by the presence of the tibial notch, and by their smaller size and more varied colors; from the Scaritides by the absence of the gap between the thorax and the elytra; from the Brachinides by the thorax and abdomen never being of contrasted colors, and by their simple claws; and from the Harpalides by their usually lighter colors and silken surface. But a considerable number of species which are black and hairless, like the Harpalides, are included with the Chlæniides proper on account of the structure of their feet. But these we shall explain more particularly in our references to particular genera.

In a strictly scientific point of view, the Chlæniides can scarcely be regarded as forming a sub family distinct from the Harpalides, but it is a matter of convenience, in practice, to subdivide very extensive groups. If we regarded structural considerations alone, a large proportion of the Carabidæ would have to be united in one great division, whilst certain anomalous genera such as *Omophron*, *Ozæna*, *Morio*, and a few others, would really constitute the types of distinct sub-families.

A. Body hirsute; head attached by a short neck; abdomen pedunculated; size below medium; colors varied with fulvous and black........PANAGÆUS, 3 sp.
A A. Body finely pubescent; head without neck; abdomen sessile; thorax narrower than abdomen; size about medium; colors mostly green or blue-black........CHLÆNIUS, 35.
A A A. Body glabrous; thorax nearly or quite as wide as abdomen; size medium or above; color black.
  B. Body elongated or elliptical; anterior angles of the thorax advanced; elytra carinated near the margin; color black, usually with rich violet or metallic tints........DICÆLUS, 21.
  B B. Body oval; thorax and elytra, ordinary color black.
    C. Head broad and obtuse; thorax a little narrower at base than elytra; mentum without tooth........DIPLOCHEILA, 3.
    C C. Head small and pointed; thorax as wide at base as elytra; mentum toothed.....OODES, 8.
A A A A. Body glabrous; thorax small; size small; color light red with black spots..BADISTER, 8.

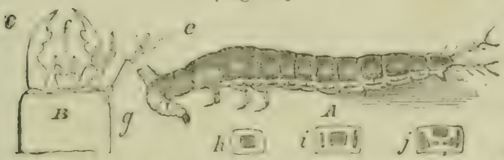
Panagæus contains two N. A. species, the *crucigerus* and *fasciatus* of Say, both of which are rare. The generic name means *holy*, in allusion to the arrangement of the spots on the elytra, in the typical species, somewhat in the form of a cross. *Chlænius* contains many species, one of the largest, most beautiful, and commonest of which is the *Chlænius sericeus* of Forst. (fig. 12), a fine green insect, with yellow legs, and clothed, like the rest of the species, with a microscopically fine silken down, or pubescence, which can scarcely be seen directly from above, but which is quite distinct when viewed side-ways, with the aid of a lens. *Dicælus* (*two-pitted*, in allusion to the hollows on the thorax) contains a number of rather rare beetles, some of which are pure black, but most of them are very richly tinted. They can be distinguished from the black Harpalides by their more elongated form, and more particularly by the shape of their thorax, which is almost square, with its anterior angles advanced, and considerably turned up at the sides.

The next two genera resemble still more closely some of the Harpalides, but the structure of the fore-feet of the males places them in the present sub-family. They are easily distinguished, however, from the great majority of the Harpalides, by having the thorax nearly or quite as wide at base as the elytra.

The meaning of the generic name *Oodes*, is, *resembling the letter O*, the species being of a regular oval form, and the thorax and elytra being of precisely the same width and closely applied to each other. In this respect they resemble the genus *Amara* among the Harpalides. The genus *Badister*, meaning *a fast walker*, is composed of a small number of pretty little glossy reddish beetles, spotted with black, a style of coloration in strong contrast with the usually dark colors of the Carabidæ.

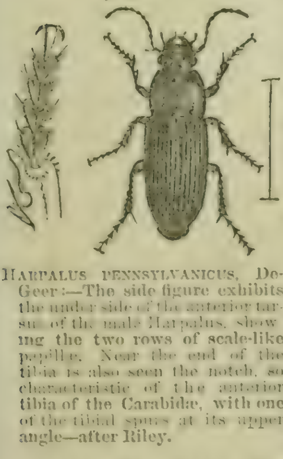
Sub-family HARPALIDES.

[Fig. 13.]



SUPPOSED LARVA OF HARPALUS (in the act of devouring a Curculio larva):—*B*, head seen from beneath; *j*, *i*, *h*, marks on under side of abdominal segments, becoming fewer towards the tip—after Walsh.

[Fig. 14.]



HARPALUS PENNSYLVANICUS, De-Geer:—The side figure exhibits the under side of the anterior tarsus of the male Harpalus, showing the two rows of scale-like papillæ. Near the end of the tibia is also seen the notch, so characteristic of the anterior tibia of the Carabidæ, with one of the tibial spurs at its upper angle—after Riley.

The Harpalides, as here defined, embrace a very extensive group of beetles, not much inferior in numbers to all the other sub-families combined; and as they are mostly of black or dark metallic colors, and as their size is for the most part limited in its range from a quarter of an inch to a little more than half an inch in length, and when we add to this that their most distinctive characters are restricted to the male sex, some idea can be formed of the difficulty of classifying them, or of referring any particular species to its proper location. Their distinctive character lies in the structure of the tarsi of the males, which often have both the anterior and middle tarsi dilated, and instead of having a uniform brush upon the under side, they are furnished with two rows of little transverse plates, or scale-like papillæ, and the hairs which border the sides of the tarsi are usually coarser, or more bristly than they are in the Chlæniides; and the angles of the dilated joints are more prominent. The first section, however, or Anisodactili, have the tarsi brushed underneath like the Chlæniides, but differ from them in having the middle tarsi as well as the anterior ones dilated; and they moreover harmonize better with the Harpalides in their general aspect.

1. Anterior and middle tarsi of the males with the four first joints dilated.

A. The dilated joints brush-like beneath.

B. Tarsi of the males only dilated; first joint not larger than the others; size never much below medium; color often inclining to brown.................................ANISODACTYLUS, 37.

B B. Tarsi of both sexes dilated; first joint much larger than the others; size small; color mostly black.................................GYNANDROPUS, 2.

A A. The dilated joints scaly beneath.

C. Mentum usually with a small median tooth; thorax sub-quadrate; tarsi not bilobed; size usually about medium; color black, rarely dark brown or green.........HARPALUS, 54.

C C. Mentum without tooth; thorax rounded; the last of the dilated joints deeply bilobed; size small; color usually wholly or in part light reddish-brown.......STENOLOPHUS, 24.

2. Anterior tarsi of males with four dilated joints, which are scaly beneath; middle tarsi not dilated; mentum toothed; size and color like Stenolophus; thorax somewhat square-shaped: BRADYCELLUS, 26.

3. Anterior tarsi of the males with the three first joints dilated and scaly beneath; middle tarsi not dilated; size about medium or below.

D. Anterior tibiæ rather stout and thickened at the tip.

E. Body more or less elongated; thorax narrower at base than elytra; size various; color mostly pure black.................................PTEROSTICHUS, 89.

E E. Body elliptical; thorax nearly as wide at base as elytra; three first joints of antennæ carinated; size medium; colors metallic.................................PŒCILUS, 13.

E E E. Body oval; thorax wider than long, and as wide at base as elytra; head small; color black or blackish.................................AMARA, 38.

D D. Anterior tibiæ slender and scarcely thickened at the tip.

F. Claws pectinate; tibiæ strongly spinous.................................CALATHUS, 11.

F F. Claws simple; tibiæ not strongly spinous; size usually below medium; often with metallic tints.................................PLATYNUS, 96.

4. Anterior tarsi of males with the two first joints dilated, and scaly beneath.

G. Palpi not acuminate; thorax heart-shaped; size medium or below; color almost always shining black.................................PATROBUS, 14.

G G. Palpi ending in a long pointed joint; thorax various; size small; color usually light brown.................................TRECHUS, 6.

5. None of the tarsi dilated; head rather broad and not narrowed behind the eyes; size various; color brownish.

H. Anterior tibiæ abruptly widened at the extremity; size large......GEOPINUS, 1.

H H. Anterior tibiæ normal; size small.................................AGONODERUS, 10.

Anisodactylus baltimoriensis, Say, nearly half an inch long, with reddish-brown elytra, and pale legs, is a very common insect, and is often seen flying in considerable numbers in the first hot days of spring. We have a considerable number of small, active, shining light-brown Carabidæ, generally less than a quarter of an inch in length, which belong mostly to the three genera, *Stenolophus*, *Bradycellus* and *Trechus*. The second are distinguished from the first, in addition to the structure of the feet of the males, by the thorax having distinct angles behind, whilst it is rounded in *Stenolophus*. The distinctive character of *Trechus* is the form of the palpi, the last joint being elongate, conical and pointed, and the joint before it being somewhat similar, but reversed, so that the two taken together form a fusiform or spindle-shaped body. *Pterostichus*, Bonelli, is now substituted for *Feronia*, Latreille, on account of the latter term having been previously used in botany. It contains a vast assemblage of species which have been divided into various sub-genera, but without any fixed distinctive characters. We have already spoken of the close resemblance between *Amara* and *Oodes* in the preceding subfamily. The males are distinguished by the structure of their feet, but the females are scarcely distinguishable. The tooth of the mentum is usually simple in *Oodes* and bifid in *Amara*, but even this character is not invariable. The remark made of *Pterostichus* will apply to *Platynus*. *Calathus* is peculiar in this sub-family for its pectinated claws, and in accordance with this structure its species are often seen on the trunks of standing trees, or under the scales of bark, sometimes in company with *Dromius* and *Lebia*. *C. gregarious*, Say, is not uncommon. *Geopinus incrassatus*, Dejean, has been found in loose soil several feet below the surface. *Agonoderus pallipes*, Fab., is one of our most common insects. It is often attracted into houses by the lamps, in summer evenings. The other species of this genus are rare.

The following are the literal meanings of the foregoing generic terms:

Anisodactylus—having *dissimilar feet.*

Gynandropus—*male* and *female feet*, referring to the widening of the tarsi in both sexes.

Harpalus—*ravenous.*

Stenolophus—having a *narrow neck* or thorax.

Bradycellus—*slow-footed.*

Pœcilus—*changeable*, alluding to their metallic colors, changing in different lights.

Calathus—*a wicker basket*, probably referring to their comb-toothed claws.

Platynus—*depressed.*

Trechus—*a runner.*

The origin of the terms *Amara* and *Patrobus*, is not apparent.

Sub-family BEMBIDIIDES.

This sub-family is composed exclusively of very small species, varying from a twentieth to a little more than a quarter of an inch in length. Their distinctive character consists in the form of the palpi, the last joint being very small and acicular, the contrast being made the more striking by the preceding joint being unusually large and swollen. The species are numerous, upwards of one hundred and forty North American species having been described, arranged in many sections or subgenera. They are almost all of a shining black color, but often exhibit beautiful brown or green reflections. They are extremely agile in their motions. A few of the smaller species are found under the bark of decayed trees, but the great majority inhabit wet places. Mr. Haliday, an accurate English entomologist, relates that some of the species which frequent the sea-shore permit themselves to be submerged by the waves.

TRIBE II.

PREDACEOUS WATER-BEETLES.

Carnivora aquatica, HYDRADEPHAGA,* MacLeay.

These insects are distinguished from those of the first tribe by their feet being fitted for swimming, the two hinder pairs being much flattened and margined with long hairs or ciliæ.

This tribe contains two families.

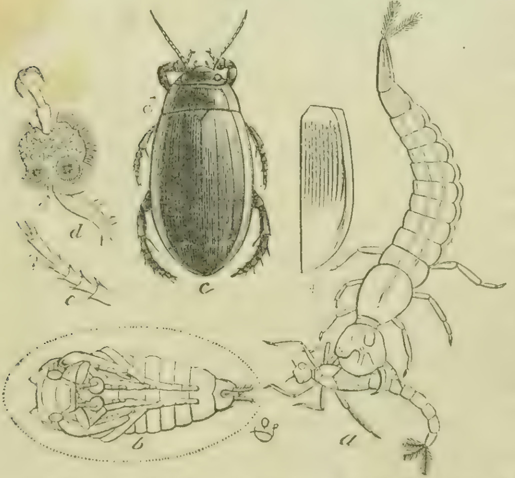
A. Antennæ slender, filiform; hind legs long, and attached to the breast far behind the other two pairs.............DYTISCIDÆ.

A A. Antennæ very short and peculiar; the three pairs of legs attached at nearly equal distances from each other; middle and hind legs very short.............................GYRINIDÆ.

Family III. DYTISCIDÆ.

This family is founded upon the genus *Dytiscus*, of Linnæus, derived from a Greek word meaning a *diver*, and given to these insects on account of their eminently aquatic habits. They are of an oval and somewhat flattened form, and of a brownish-black color, generally with a dull glaucous or sea-green tint. In some species the thorax is dull yellow, either with or without black cross-bars. One of their most distinctive and easily recognized characters is the position of the middle legs close to the anterior ones, leaving an unusually long space between the middle and the hind legs. These insects are eminently aquatic and predaceous, and may be supposed to represent the sharks and other ferocious aquatic animals of the higher classes.

[Fig. 15.]



DYTISCUS:—*a*. larva of *D. marginalis* devouring a larva of Ephemera—after Rœsel; *b*, pupa of same—after Rye; *c*, *D. fasciventris*, Say, the detached figure on the right showing the grooved elytron of the female; *d*, the anterior tarsus of the male, under side, showing the suction cups; *e*, same of female—after Riley.

They have sometimes been found very troublesome in artificial fish-ponds, attacking the young gold and silver fishes and eating off their fins. The larvæ leave the water and make little cavities in the earth, when about to transform. Two hundred and thirty North American species have been described, arranged, for the most part, in the following genera:

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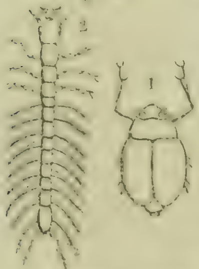
* From the Greek *hudor—water*; and *adephagos—ravenous*.

A. Antennæ 10-jointed; hind coxal plates greatly dilated, so as to cover half of the abdomen; legs slightly natatorial; size small; form somewhat pointed before and behind; color yellowish spotted with blackish.......HALIPLUS, 15.
A A. Antennæ 11-jointed; coxal plates obsolete; legs strongly natatorial.
  B. Tarsi distinctly 5-jointed, not bilobed; scutellum distinct (except in Laccophilus).
    C. Anterior tarsi of males widened and forming a rounded disk with cups beneath of very unequal size; generally large or medium-sized insects.
      D. Hind tarsi with one claw; size very large, exceeding an inch in length.......CYBISTER, 3.
      D D. Hind tarsi with two claws.
        E. Claws equal, or nearly so; size large, or very large.......DYTISCUS, 11.
        E E. Claws unequal.
          F. Body oval, depressed; size about medium.......ACILIUS, 6.
          F F. Body elliptical; convex; size below the medium.......HYDATICUS, 9.
    C C. Anterior tarsi of males widened, with the joints oblong and with cups of about equal size; size usually below medium.
      G. Scutellum distinct; length between a quarter and a half of an inch.
        H. Hind claws unequal; form less convex.......COLYMBETES, 25.
        H H. Hind claws equal; form more convex.......AGABUS, 47.
      G G. Scutel wanting; hind legs stout, compressed; length quarter of an inch or less: LACCOPHILUS, 9.
  B B. Tarsi apparently 4-jointed; third joint bilobed; scutellum wanting; size very small: HYDROPORUS, 91.

Family IV. GYRINIDÆ.

Founded upon the genus *Gyrinus*, a name derived from a Greek word meaning a *circle*, and given to these insects on account of their habit of swimming round in little circles upon the surface of the water. The antennæ are very short and peculiar, and of the form called *auriculate*. The second joint is large and ear shaped, and the following ones form a short spindle-shaped mass. They are inserted in a little cavity in front of the eyes. The middle and hind legs are very short, scarcely reaching beyond the sides of the body, and very broad and flat like little plates. These insects are of a medium or small size, of a shining blue-black color, and are often seen in dense flocks playing and gyrating upon the surface of still water. Number of N. A. species, thirty-seven.

Fig. 16.



GYRINUS: 1, beetle; 2 larva (after Packard).

Second Sub-section, CLAVICORNES.

Antennæ club-shaped. Subsist mostly upon decaying animal or vegetable substances.

TRIBE III.

WATER SCAVENGER-BEETLES.

Putrivora aquatica, PHILHYDRIDA,* MacLeay.

This tribe commences the series of beetles with clubbed antennæ, a character which at once distinguishes the insects of this tribe from the predaceous water-beetles, with which they might otherwise be confounded on account of their aquatic habits and similarity of form. This tribe is composed of two very distinct sub-tribes.

Sub-tribe 1. *Macrodactyla*, Latreille. Legs not fitted for swimming. Last joint of the tarsi very long, often as long as all the others united, and for this reason called Macrodactyla, which means *long-toed*. Palpi of ordinary length. Antennæ moderately clavate. Body clothed with silken hairs. Family, Parnidæ.

Sub-tribe 2. *Palpicornes*, Latreille. Legs fitted for swimming (except the Sphæridiidæ). Palpi very long, usually longer than the antennæ. Antennæ strongly clavate. Body glabrous.

These insects feed upon decomposing matter in water, and are one of the agencies which prevent water from becoming offensive in a state of nature. But some of them have been observed to be carnivorous in the larva state.

The first sub-tribe are semi-aquatic, being found in mud, or adhering to stones under water by means of their stout claws. The second sub-tribe (except the Sphæridiidæ) are purely aquatic, but less rapid in their motions than the predaceous water-beetles. Each of the sub-tribes is represented by one principal family, the Parnidæ representing the first division and the Hydrophilidæ the second.

Family V. PARNIDÆ.

These are small sub-aquatic insects which have been sufficiently characterized above. The family is composed of three leading genera. *Parnus*, Fab., having the antennæ enlarged at base and at tip, and the hind coxæ dilated into a plate for the protection of the thighs; *Elmis*, Latr., with the antennæ almost filiform, and the hind coxæ not dilated; and *Heterocerus*, Fab., with the antennæ much like Parnus, but the mouth organs are more strongly developed, and the anterior and middle tibiæ are widened and armed with spines on the outer edge, by which they are enabled to burrow in the wet sand which they and their larvæ inhabit.

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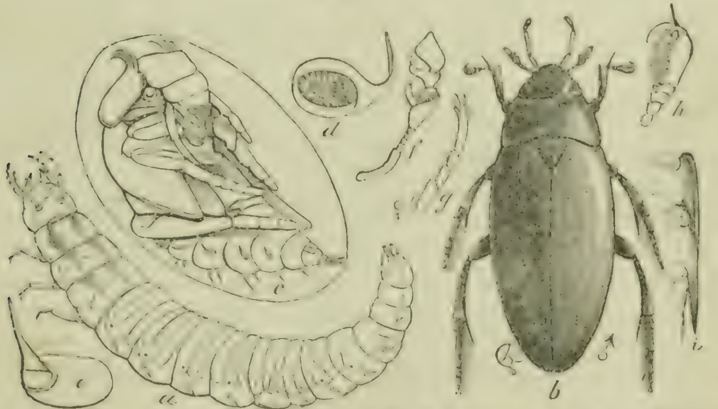
*From the Greek *phileo—to love*; and *hudor—water*.

The last genus is regarded by many as constituting the type of a small family distinct from the Parnidæ. Most of these imperfectly aquatic insects are clothed with fine silken hairs which seem to have the property of shedding the water, and of enabling the insect to surround its body with a globule of air whilst clinging to the stones beneath the surface; whereas the purely aquatic beetles, the Dytiscidæ, the Gyrinidæ and the Hydrophilidæ, which have the faculty of swimming and of rising to the surface of the water whenever they need a fresh supply of air, have no such clothing. Forty-eight N. A. species are known. A synopsis of the Parnidæ of the United States is given by Dr. Geo. H. Horn in the 3d. vol. of the Tran. Am. Ent. Society.

Family VI. HYDROPHILIDÆ.

[Fig. 17.]



HYDROPHILUS:—*a*, larva of *H. piceus*, Linn.; *e*, egg-case; *d*, same opened showing arrangement of eggs; *c*, pupa—after Blanchard: *b*, *H. triangularis*, Say., natural size; *f*, antenna; *g*, anterior tarsus of female; *h*, same of male, all magnified; *i*, side view of the sternal spine—after Riley.

This family is named from the genus Hydrophilus, a word of Greek composition meaning a *lover* of *water*. They constitute a somewhat extensive series of water-beetles, but less numerous and less eminently aquatic than the Dytiscidæ. In swimming they move the hind legs alternately, whilst the Dytiscidæ strike with them both together like a frog. Both of these families contain both large and small species, the largest being an inch and a half in length. Many of the larger species of Hydrophilidæ have the sternum or breast bone in the form of a keel, and prolonged posteriorly to a sharp point. They are essentially distinguished from the predaceous water-beetles by their short clavate antennæ and their long palpi, which are usually longer than the antennæ, and are carried projecting forwards whilst swimming. The larvæ of Hydrophilus are predaceous. The names of one hundred and twenty-two N. A. species are given in Dr. LeConte's catalogue, inclusive of twenty-one species of the small sub-family of Sphæridiides.

A. Middle and hind tarsi with the first four joints short; the last often as long as all the others; body oblong; thorax furrowed, and narrower than the elytra; size small...... HELOPHORUS.
A A. Middle and hind tarsi with second joint elongated, first very short; body oval; thorax as wide at base as elytra.
  B. Metasternum keeled and prolonged backward into a sharp spine; tarsi flattened; size large or very large...... HYDROPHILUS.
  B B. Metasternum not prolonged; tarsi not compressed; size small or very small.
    C. Hind tibiæ and tarsi ciliate; scutellum elongated...... BEROSUS.
    C C. Hind tibiæ and tarsi not ciliate; scutellum regularly triangular...... HYDROBIUS.
A A A. Middle and hind tarsi with the first joint elongated; body short and sub-globular; size very small; not aquatic; found in cow-dung...... SPHŒRIDIUM.

TRIBE IV.

LAND SCAVENGER-BEETLES.

Putrivora terrestria, NECROPHAGA *partly*, Latreille.

This tribe embraces an extensive series of useful scavengers, whose office it is to hasten the decomposition and removal of dead organic matter. The typical species are found upon dead animals or other decomposing animal substances. Some of the smaller species are found under the bark of dead trees; whilst others feed upon fungi, especially those which grow upon decaying trees. The only other insects which can be compared with these in usefulness as scavengers, is the extensive family of *Muscidæ*, in the two-winged flies. It is interesting to observe the order in which these various tribes of scavenger insects perform their respective parts. First come the Muscidæ, which, in the form of carrion flies, deposit their eggs or *fly-blows* upon dead animal matter at the first moment of decay, and, in very hot weather, almost immediately after life has ceased. Soon after these come the carrion-beetles, the Silphæ and Necrophori, whose larvæ, like the maggots of the flesh-flies, are seen revelling in the putrescent matter at the most offensive stage of decomposition. When the softer parts have been devoured and only the osseous and ligamentary portions remain, other families of scavengers succeed, namely: the skin-beetles, *Dermestidæ*, and the bone-beetles, *Necrobii* and *Nitidulæ*, which adhere to the dried carcass as long as any vestige of animal matter remains.

The scavenger-beetles, with a few exceptions, are readily distinguished from the other pentamerous Coleoptera by the form of their antennæ, which, in the great majority, are strongly clavate, and sometimes capitate or knobbed.

The number of joints in the tarsi are much more variable in this than any other tribe or section; and though the larger species very uniformly possess five joints in all the tarsi, in many of the very small species one of the joints, especially in the posterior tarsi, is either rudimental or wanting. The place of these insects in the system has to be determined therefore by the examination and collection of their other characters.*

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* See suggestions on pages 30 to 34.

Indeed, in some of the families which are usually classed with the pentamerous clavicorns, both of the leading characters, the clubbed antennæ and the five-jointed tarsi, either partially or wholly fail. Some of these insects also depart widely in their habits from the scavengers proper, and might therefore very properly be separated as a tribe by themselves were it not for the absence of any very strongly marked community of characters. In order to guard against mistake we have thought it best to throw these exceptional families together, as a sub-tribe, under the title of sub-clavicornes.

The tribe of land-scavengers may therefore be divided into two sub-tribes differing very considerably from each other, both in structure and habits, and which may be distinguished as follows:

1st Sub-tribe.—*Clavicornes*, proper. Body more or less oval; antennæ clavate or capitate; usually three, sometimes more than three joints in the club; usually five joints in all the tarsi, or, at least, in the anterior ones; subsist mostly upon animal or vegetable substances, in a state of decay. This division includes the families Silphidæ, Scaphidiidæ, Histeridæ, Nitidulidæ, Dermestidæ, Mycetophagidæ, Cryptophagidæ, Byrrhidæ, Anisotomidæ, Phalacridæ, Trichopterigidæ and Scydmenidæ.

2d Sub-tribe.—*Sub-clavicornes*. Body more or less elongated; antennæ almost filiform, or granose, or moderately and loosely clavate, sometimes with less than three joints in the club; tarsi, in many, less than five-jointed. Found mostly under the bark of dead trees. They never feed upon dead animal matter, but recent observations show that many of them are carnivorous or vermivorous, at least in their larva state, preying upon the soft larvæ of the wood and bark-eating insects. Composed of the families Trogositidæ, Cucujidæ, Colydiidæ and Lathridiidæ.

FAMILIES OF LAND-SCAVENGERS

Sub-tribe 1st. CLAVICORNES.

A. Body oval or elliptical; antennæ clavate or capitate. Anterior tarsi almost always five-jointed.

  B. Large insects, the smaller not much less than half an inch in length (except Catops.) Hind trochanters prominent. Thorax with a thin margin.................SILPHIDÆ.

  B B. Small insects less than half an inch, mostly less than quarter of an inch in length.

    C. Wing-cases shorter than the abdomen.

      D. Abdomen thick, conical and pointed, first segment very long..............................SCAPHIDIIDÆ.

      D D. Abdomen rounded behind.

E. Head very small and retractile. Body very hard, color shining black.......................... Histeridæ.
E E. Head moderate. Color usually dull brown, with or without spots...................... Nitidulidæ.
C C. Wing-cases covering the whole abdomen.
F. Head inserted in the thorax; thorax as broad at base as the abdomen.
G. Wings not fringed with long hairs.
H. Body moderately convex, pubescent. Antennæ strongly clavate.
J. Prosternum advanced beneath the retractile head.......................... Dermestidæ.
J J. Prosternum not advanced.
K. Body strongly pubescent, often prettily spotted................ Mycetophagidæ.
K K. Microscopically pubescent, generally unspotted .... Cryptophagidæ.
H H. Body very convex, or sub-globular.
L. Medium or small insects; body thick, ovoid, pubescent, sometimes variegated: Byrrhidæ.
L L. Very small insects; body glabrous, black, rarely spotted with red.
M. Club of antennæ 3 or 5-jointed. Body usually contractile into a ball: Anisotomidæ.
M M. Club 3-jointed. Body not contractile: Phalacridæ.
G G. Wings fringed. Size minute. Tarsi 3-jointed: Trichopterigidæ.
F F. Head, free. Abdomen, much wider than the ovoid thorax. Size very small........ Scydmænidæ.

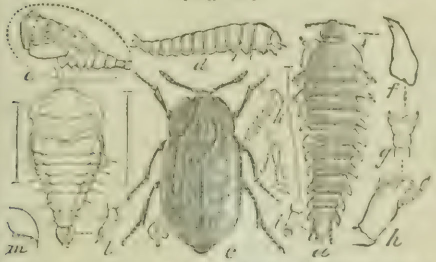
Sub-tribe 2d. Sub-Clavicornes.

A A. Body usually elongated. Antennæ slightly clavate, or filiform and granose. Tarsi often with less than five joints.
N. Body somewhat depressed, smooth. Tarsi five-jointed, first joint very small. Color black, or dark red.. Trogositidæ.
N N. Body very flat, smooth. Color red or brown.. Cucujidæ.
N N N. Body not very flat: sometimes cylindrical, usually deeply sculptured, or scabrous. Tarsi less than five-jointed.
O. All the tarsi four-jointed .... Colydiidæ.
O O. All the tarsi three-jointed................ Lathridiidæ.

Family VII. SILPHIDÆ.

This family is founded upon the genus *Silpha*, a name originally given by the Greeks to some kind of fœtid beetle, and appropriated by Linnæus to the leading genus of the present family. These insects are most readily distinguished from the other Necrophaga by their large size. The species of Silpha are usually half an inch and upwards in length, whilst some of the burying beetles, composing the genus Necrophorus, are an inch and a half. The other leading characters are the orbicular or rounded thorax, very thin all around at the margin, and slightly overlapping the base of the elytra. The club of the antennæ is perfoliate and 4 or 5 jointed. The hind trochanters are also prominent, especially in Necrophorus; but they are not swolen or sub-globular, as they are in the land predaceous beetles. The Silphæ, in company with their larvæ, are found on dead and putrid animals.* The Necrophori have the curious instinct to deposit their eggs in small dead animals or fragments of putrid flesh, and then bury them in the ground several inches, and sometimes nearly a foot in depth. The larvæ hatching from these eggs feed upon the decayed flesh, and, it is said, devour even the bones of small animals.

[Fig. 18.]



Silpha inæqualis, Fab.:—a, larva; d, same, natural size; *f, g, h*, mandible, labium, and maxilla of larva; *i, j*, anal process and antennæ of same; *m*, one of the lateral processes more highly magnified; *b*, pupa; *c*, same, natural size; *l*, anal process of same; *c*, beetle; *k*, anterior tarsus of same—after Riley.

There is a small group of dusky or blackish beetles belonging to the genera Catops and Colon, which are less than a quarter of an inch in length, which are usually classed with the Silphidæ, and consequently form an exception to the majority of the family with respect to size.

Fifty-five North American species have been described.

The three leading or typical genera may be thus described:

A. Antennæ capitate; head large and free. Large thick bodied insects; color black, elytra spotted with reddish-yellow..NECROPHORUS.

A A. Antennæ clavate and perfoliate; head small; size medium; body broad and flattened; color black: thorax in many margined with yellow..SILPHA.

A A A. Antennæ sub-clavate; head partly immersed in the thorax; size small; form ovate; color black or brown..CATOPS.

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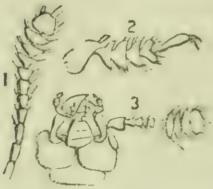
* A remarkable exception to the usual habits of this family, occurs in the case of a small European species, (*Silpha opaca*, Linn.) the larvæ of which have been known to feed, to an injurious extent, upon the leaves of the beet and the mangel-wurzel. Curtis' Farm Insects, p 388.

The *Necrophorus Americanus* is nearly an inch and a half in length. The other species do not exceed an inch, and a few of the smaller species scarcely exceed half an inch in length. *Silpha Americana* has the thorax broadly margined with yellow; *S. marginata* has the thorax margined with red; *S. inequalis* [Fig. 18] is wholly black; *S. caudata* has adull bronze thorax, and black elytra, with many small tubercles. The *Necrodes surinamensis* is black, with a reddish spot near the end of each elytron, and the elytra strongly carinated or ridged. Necrodes differs from Silpha in having a more elongated form, and the antennæ with a greater number of perfoliate joints.

[Fig. 19.]



NECROPHORUS:—1, antennæ; 2, tarsus; 3, head from beneath—after Westwood.

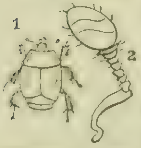
Family VIII. SCAPHIDIIDÆ.

From the genus *Scaphidium* of Olivier, a name meaning a *little skiff* or *boat*, and given to these insects on account of their fancied resemblance to a boat, being thickest and arched in the middle, and narrowed towards each end, the head being very small, and the tip of the abdomen being conical and pointed, and projecting beyond the end of the wing-cases. The first abdominal segment is unusually long. These are small, shining-black insects found in fungi and rotten wood. They move rapidly, but with an uneven or skipping gait. They constitute a very small family, only seventeen N. A. species having been described at the present time.

Family IX. HISTERIDÆ.

Founded upon the genus *Hister* of Linnæus, a term borrowed from the Latin *hister*, or *histrio*, meaning a *stage actor* or *mimic*, and applied to these insects on account of their habit of persistently feigning death when captured; a habit, however, which they have in common with many other Coleoptera. They are mostly small, short, rounded or somewhat square-shaped beetles, of a very hard consistency, and a glossy black color, very rarely marked with a few red spots. They are further distinguished by their small heads, which can be retracted into the thorax, so as to be nearly or quite invisible; and also, by their truncated or shortened wing-cases, leaving the two last abdominal segments exposed. They live in the excrement of animals, and other decomposing substances, mostly animal, but sometimes vegetable.

[Fig. 20.]



HISTER:—1, beetle natural size; 2, antennæ of same magnified—after Westwood.

Number of described N. A. species, one hundred and eighty-four.

The following are the three typical genera:

A. Head porrected; mandibles as long as the head; body very flat; size comparatively large—HOLOLEPTA.
A A. Head retracted; mandibles short; body usually convex, (flattened in sub-genus Paromalus.)
  B. Prosternum advanced so that the head is invisible from beneath........................HISTER.
  B B. Prosternum not advanced........................SAPRINUS.

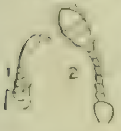
Hister is divided by Dr. LeConte into ten lesser genera, which De Marseul has still further subdivided so as to form four additional ones. These divisions are made in accordance with slight organic variations, which however are sometimes accompanied by differences in size, or by perceptible modifications of the general form.

More recently, Dr. Geo. H. Horn has contributed to the American Philosophical Society (June, 1873,) a valuable synopsis of the Histeridæ of the United States, in which all our species are carefully reviewed and described.

Family X. NITIDULIDÆ.

The typical insects of this family constitute the genus *Nitidula* of Fabricius, a word literally meaning *shining*, or *elegant*, but which is singularly inapplicable to the insects of this family, as now constituted, most of which are clothed with a fine pubescence, which is incompatible with a shining surface. They are small, somewhat flattened beetles, the thorax having a wide, thin margin, and the wing-cases more or less cut off behind, so as to leave the end of the abdomen exposed. In the sub-family of Carpophilides, the elytra are so short as to leave two or three of the abdominal segments uncovered, but in the Nitidulides only the tip of the abdomen is exposed. The fourth tarsal joint is very small, and wholly wanting in the hind tarsi of the males of some species. Their colors are usually brown or blackish, with or without dull yellow spots.

[Fig. 21.]



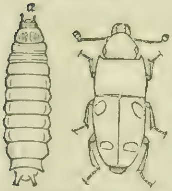
NITIDULA:—1, anterior tarsus; 2, antennæ—after Westwood.

The insects of this family vary much in their habits. Some are found on carrion and others on flowers; several of the most common species are often met with on apples and other fruit in a state of decay. The larvæ of the genera Ips Carpophilus and Rhiozophagus, have been shown by the observations of a French author, M. Ed. Perris, to be carnivorous, subsisting upon soft, sub-cortical larvæ.

Ninety N. A. species have been described, under the following principal genera:

A. Antennæ 11-jointed, club 3-jointed; body oval.
  B. Only the tip of the abdomen exposed.
    C. Surface pubescent; colors dull; upper lip exposed.
      D. Body depressed; thorax not overlapping the elytra; color brown, usually with obscure yellow spots........................NITIDULA.
      D D. Body convex; thorax slightly overlapping the base of elytra. Color brown, usually shaded with black........................CYCHRAMUS.
    C C. Surface smooth and shining; color black, spotted with yellow or reddish; labrum concealed: IPS.
  B B. Two or three last segments of abdomen uncovered by elytra........................CARPOPHILUS.
A A. Antennæ 10-jointed; club solid; body elongated........................RHIZOPHAGUS.

[Fig. 22.]

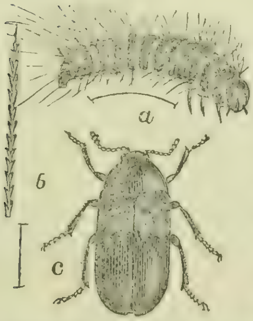


IPS FASCIATUS:—Larva and beetle—after Packard.

Ips fasciatus, a shining black species, quarter of an inch long, with two conspicuous, interrupted reddish bands across the elytra. *Nitidula bipustulata*, a blackish brown insect, with a yellow dot on the middle of each elytron, one-sixth of an inch long; and *Omosita colon*, a little species one-tenth of an inch in length, brown, the elytra pale at the tips with two minute dots, like a colon—are the three most common species.

Family XI. DERMESTIDÆ.

[Fig. 23.]



DERMESTES LARDARIUS, Linn.:—*a*, larva; *b*, one of the larval hairs greatly magnified; *c*, beetle—after Riley.

This family is founded upon the genus *Dermestes*, of Linnæus, a name derived from the Greek *derma—a skin*, and *esthio—to devour*, and applied to these insects because some of the species are destructive to skins and furs, and other dried animal substances. They differ from the three preceding families in having the abdomen completely covered by the wing-cases; but they are more particularly distinguished by having the sternum or breast-plate advanced under the mouth like a chin-cloth; by their short and contractile legs and antennæ, and by their coloration, which consists of light-colored spots on a darker ground, the spots being produced by minute scales which can be rubbed off. The larvæ are rather hard, brown, active grubs, more or less clothed with stiff hairs, which usually form a long brush at the end of the body.

Forty-nine N. American species have been described.

A. No ocellus or eye-like spot on the front. Size from quarter to half an inch in length: DERMESTES.
A A. Frontal ocellus distinct; less than quarter of an inch in length.
  B. Middle coxæ not widely separated........ATTAGENUS.
  B B. Middle coxæ widely separated; size very small........ANTHRENUS.

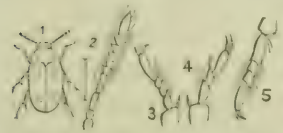
The *Dermestes lardarius*, Linn., so called because it is usually found upon refuse lard and bacon, is our most common species. It is an oblong oval, black beetle, one-third of an inch in length, with a broad, brownish-yellow band across the middle of its body, and in the middle of this band a transverse row of black dots.

Another species often found in houses, is the *Attagenus pellio*, which, like the former, was originally an European insect, but which has now become distributed over the civilized world. It is two-tenths of an inch long, black with a white dot on the middle of each wing-cover, which is wanting in some specimens, having probably been rubbed off. The larvæ destroy dried skins, furs and woolens, and are said even to gnaw linen and cotton fabrics. They are sometimes quite injurious to carpets whilst lying upon the floor. We have known them to select a particular stripe, especially one of red flannel, in the domestic fabric known as rag-carpet, and follow it out into the middle of the room, gnawing it off at intervals. They have to be treated upon general principles, no specific remedy, we believe, having been discovered. Some very small species, belonging to the genus Anthrenus, are very destructive to cabinets of natural history. Other small species are found on flowers.

Family XII. MYCETOPHAGIDÆ.

Founded upon the genus *Mycetophagus*, a word which means a *mushroom-eater*, and therefore indicates the habits of the family. They are small, or very small, oval, moderately convex, pubescent, and usually prettily marked insects. This is one of the families of small Coleopterous insects in which the number of tarsal joints is very variable, not unfrequently differing in the sexes of the same species.

[Fig. 24.]



MYCETOPHAGUS:—1, beetle; 2, antenna; 3, anterior tarsus of male (♂); 4, same of female (♀); 5 posterior tarsus—after Westwood.

The only preceding family with which it is liable to be confounded, is that of the Nitidulidæ; but it differs: first, in the antennæ, which are knobbed in Nitidulidæ, and usually gradually clavate in the Mycetophagidæ; second, in the elytra, which cover the whole abdomen in the latter, and are almost always truncated, though often but very slightly in the former; and thirdly, in the character of the pubescence or down upon the surface, which is scarcely perceptible or wanting in the former, whereas the Mycetophagidæ are densely clothed with prostrate hairs. They are also more uniformly and conspicuously spotted than the Nitidulidæ, the elytra usually exhibiting yellow spots or bands on a brown or blackish ground.

Our largest species is the *M. punctatus*, Say, upwards of two-tenths of an inch in length, blackish; elytra reddish-yellow, with a large black spot including the scutellum, another at the side, and another near but not including the tip.

M. flexuosus, Say, is three-twentieths of an inch in length, blackish; elytra redish-yellow; a large transverse black spot on the region of the scutellum; a small rounded one on the shoulder; a large irregular one on the side, sometimes extending to the suture, and a large black spot on the tip, enclosing a small fulvous spot.

About twenty N. A. species are known.

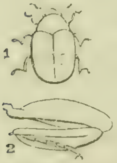
Family XIII. CRYPTOPHAGIDÆ.

This family name means essentially the same as the preceding one, and implies that the insects which compose it feed upon Cryptogamous plants, which include the mushrooms and fungi. They are very small insects, usually less than one-tenth of an inch in length, of a light-yellowish brown color, and usually having a silken lustre, produced by a microscopically fine pubescence. They are distinguished from the Mycetophagidæ by their usually smaller size, their finer pubescence, the absence of spots, and in the typical and most numerous genus by little saw-like teeth along the sides of the thorax. The *C. cellaris* and *C. crinitus* are often found in cellars.

Upwards of thirty N. A. species have been described.

Family XIV. BYRRHIDÆ.

[Fig. 25.]



Byrrhus:—1, beetle; 2, hind leg, partially folded up and seen from within—after Westwood.

The Byrrhidæ are distinguished from all other pentamerous clavicorns by their short and very strongly arched or convex bodies, taken in connection with the hairs or minute scales by which the surface of their bodies is more or less clothed and ornamented. The family includes moderately large and very small species—some of the species of the typical genus Byrrhus* being from one-quarter to one-half of an inch in length. All the other beetles of this tribe, which have very strongly convex or sub-globular bodies, are distinguished from the Byrrhidæ by being small or very small insects, with a shining or polished surface. The Byrrhidæ are further distinguished by the extreme contractility of their members—the joints of their legs being capable of being shut so closely upon each other and upon the body, that they are scarcely distinguishable, except upon close inspection. This, together with their sub-globular form, suggested to Linnæus the specific name of *pilula*, for a European species, from its resemblance to a pill or little ball of inanimate matter. These insects are found upon the ground, often in sandy situations, also at the roots of trees and grass. Some species are known to feed upon the mosses.

Thirty-two N. A. species are known.

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* This name, which is supposed to have been derived from the Greek *bursa*—a *hide*, from some fancied resemblance in texture, was originally given to these insects by Linnæus, in the twelfth edition of the *Systema Naturæ*, in 1766. Mr. Crotch, in his recent Check List of N. A. Coleoptera, suppresses this name and adopts the name of Cistela, previously given to this genus by Geoffroy, but since applied to a genus of heteromerous beetles. But we prefer to retain the name given by Linnæus, and established by universal usage for more than a century.

Family XV. ANISOTOMIDÆ.

This family of minute Coleoptera is composed chiefly of the genera *Anisotoma* and *Agathidium*, of Illiger. The first term signifies *unequal division*, and has reference probably to the structure of the antennal club, which, in the sub-family Anisotomides, consists of five joints, the second of which is the smallest. Mr. Westwood regards the second genus as the type of the family, which accordingly he denominates AGATHIDIIDÆ. But the other term is adopted by the most recent writers. These insects are remarkable for their very small size and their sub-globular bodies, those of the sub-family Agathidiides having the power to contract the head and thorax upon the abdomen so as to form a little ball. The thorax is orbicular with thin edges, like that of the comparatively gigantic Silphidæ, with which, indeed, they are united as a sub-family by the principal modern authorities, such as Erichson, Lacordaire and LeConte.

These minute insects are found mostly in fungi and rotten wood, and can frequently be caught flying in the evening.

Number of described N. A. species, thirty-five.

Family XVI. PHALACRIDÆ.

A small family of very small, convex, shining black insects, sometimes two-spotted or tipt with red; formerly confounded with the preceding family, but separated from it by a Swedish naturalist, Paykull, under the generic name of *Phalacrus*, a word meaning *bald-headed*, and suggested probably by the rounded, shining aspect of these beetles. They differ from Anisotoma in having but three joints in the club of the antennæ, and from Agathidium in not being contractile, nor in having the hind margin of the thorax overlay the base of the elytra. They differ also in their habits from the foregoing family, being usually found upon flowers.

Twenty N. A. species have been described.

Family XVII. TRICHOPTERYGIDÆ.

This family surpasses the two former in the minuteness of its species—the largest not exceeding small pin-heads in size, and the smallest not being one-quarter as large—the species varying from about one-twentieth to one-seventieth of an inch in length. Nevertheless, it is one of the wonders of nature that within the almost infinitissimal compass of their minute beings are contained all the divisions, the limbs and organs of the most gigantic species. The family is founded upon the genus *Trichopteryx*, of Kirby—a term meaning *hairy-winged*, in reference to the peculiar construction of the inferior or true wings, which are composed of a little lamella or plate, supported at the end of a slender footstalk, and ornamented with a fringe of long hairs. In some the wings are wanting. The elytra are sometimes truncated. The club of the antennæ is usually four, rarely two jointed. The tarsi are only three jointed, with a club-tipt bristle between the claws. The surface is often pubescent. Some live in rotten wood and others in manure; a few have been found in ants' nests.

Thirty-eight N. American species have been described.

Family XVIII. SCYDMÆNIDÆ.

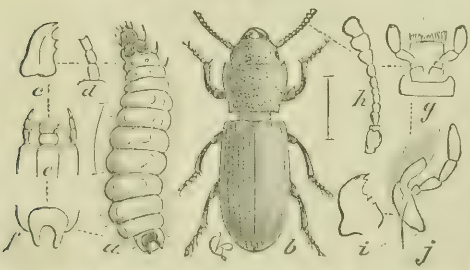
This is another family of very small insects, found under stones or in waste matter, and in ants' nests. They are of a brown color, and are clothed with erect hairs. They are frequently seen flying in twilight. They are very easily distinguished from the small beetles of the three preceding families, by their more oblong ovate form, by the head separated from the pro-thorax by a distinct neck, and by their large abdomens, much wider than the somewhat egg-shaped thorax. They bear the closest relationship to the more extensive family of Pselaphidæ, treated of below, from which, however, they are strongly separated by their five jointed tarsi, and their elytra covering the whole abdomen.

Thirty-eight N. A. species already described.

Family XIX. TROGOSITIDÆ.

Founded upon the genus *Trogosita*, of Olivier, a name composed of the Greek words *trogo—to eat*, and *sitos—grain*, and originally applied to the most notorious species, the *Trogosita mauritanica*, (*Tenebrio mauritanicus*, Linn.) because it is often found in great numbers in worm-infested granaries. But observations recently made upon the carnivorous habits of other species of the genus, render it probable that the larvæ of the *T. mauritanica* live upon the larvæ of the Calandræ and Tiniæ, which are the real authors of the damage. This view is confirmed by our own observations upon the larva of a common American species, the *Trogosita corticalis*, of Melsheimer, which we have seen preying upon the larva of the Codling-moth (*Carpocapsa pomonella*). The Trogositidæ are oblong, somewhat depressed or flattened beetles, of a black or reddish black

[Fig. 26.]



TROGOSITA CORTICALIS, Melsh.:—*a*, larva; *c*, its mandible; *d*, antenna; *e*, under side of head; *f*, the two-horned anal plate; *b*, the beetle; *h*, its antenna; *i*, mandible; *g*, labium and its palpi; *j*, one of the maxillæ and its palpus—after Riley.

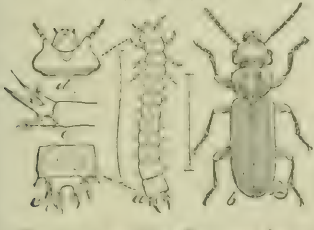
color, usually found under the bark of decaying trees. Their antennæ are short, but reaching back, at most, beyond the middle of the thorax. The club consists of three somewhat moniliform joints, not conspicuously larger than the preceding ones. The tarsi are apparently four jointed, the first joint being so short that it cannot be seen from above; the last joint is very long, often as long as all the others united. In Trogosita proper, the thorax is separated from the abdomen by a short neck or strangulation. The larva of Trogosita is a whitish flattened grub, with a pair of black spots on the top of the three first segments. The tail terminates in two horny points.

Number of N. A. species, forty.

Family XX. CUCUJIDÆ.

The insects of this family are most conspicuously distinguished by their very flat bodies and by their projecting mandibles. Antennæ usually longer than the head and thorax, filiform, and generally granose or moniliform. In the small subfamily of Silvanides, the three last joints are moderately enlarged. The tarsi, like those of the preceding family, are apparently four jointed, the first joint being very small. Both of these families are classed by Latreille with the Tetramera. Most of these insects are brown, but some of the Cucuji proper are of a bright red color. They are found under the bark of trees, but the larvæ, so far as they have been observed, are found to be carnivorous. M. Perris discovered the larvæ of *Brontes planatus* feeding upon Poduræ, acari, and the larvæ of the wood-boring beetles of the genus Tomicus. And in England, Mr. C. C. Babington and Mr. Westwood saw the *Cucujus testaceus* in abundance in granaries, from which, in connection with the similarity of the larvæ, we may conclude that they have the same useful habit as the insects of the preceding family in counteracting the ravages of the destructive grain worms.

[Fig. 27.]



CUCUJUS CLAVIPES, Fabr.:—a, larva; c, e, enlarged back and side views of its anal joint; d, of its head; b, beetle.—after Riley.

Number of described N. A. species, forty-two.

The following is a table of the principal genera:

A. Antennæ moniliform, not thickened at the tip, half as long as the body, or less; size, more than one-quarter of an inch in length.
  B. Posterior angles of the head rounded and prominent; color, scarlet........................CUCUJUS.
  B B. Posterior angles of the head not prominent; color, brown..............................CATOGENUS.
A A. Antennæ sub-moniliform, more than half as long as the body, usually a little thickened at the tip; size, very small..LÆMOPHLŒUS.
A A A. Antennæ long and filiform, first joint elongated; size, small..........................BRONTES.*
A A A A. Antennæ with the last three joints forming a loose club; size, very small........SILVANUS.

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*This name, given to this genus by Fabricius, is discarded in Mr. Crotch's Check List as having been preoccupied, and *Uliota*, Latreille, substituted.

Cucujus, Fab., contains but one N. A. species, the *C. clavipes*, Fab.; *Catogenus*, Westw., one, the *C. rufus*, Fab.; *Læmophlæus*, Lap., ten species; *Brontes*, Fab., three species; and *Silvanus*, Latr., nine species.

The word *Cucujus* comes from the Brazilian Cucuyo and Spanish Cucujo, a name given by the natives to the luminous snapping-beetle (*Elater noctilucus*, Linn.) of South America.

Family XXI. COLYDIIDÆ.

This family includes two principal types. In one, forming the sub-family Colydiides, the species are elongate and cylindrical, with ribbed or striate elytra, and in the other, or the sub-family of Synchitides, the species are simply oval or oblong, somewhat flattened, and remarkable for their rough or spinous bodies. The antennæ are either moderately and gradually clavate, or terminate in a small club, which usually includes but two joints. The tarsi are all strictly four-jointed. These insects have the same carnivorous habits which seem to be common to most of the species included in our division of sub-clavicornes. The larvæ of *Ditoma*, of *Aulonium*, and of *Cerylon*, have all been seen depredating upon the larvæ of Tomicus and other small wood-boring beetles, and one species, at least, the *Cerylon histeroides*, is equally predaceous in its perfect state.

Forty-four N. A. species have been described.

Family XXII. LATHRIDIIDÆ.

Very small and not very common insects, sometimes found under stones and sometimes caught flying. They are of an oblong form, the abdomen being wider than the thorax. The antennæ terminate in a small club of one, two, or three joints. The tarsi are three-jointed, the last joint being at least as long as the other two. The thorax has a raised border, and the elytra are puncto-striate, and ribbed between the striæ.

About fifty N. A. species have been described.

Third Sub-section, MONILICORNES.

Antennæ often moniliform or bead-like; subsist mostly upon decaying vegetable substances.

TRIBE V.

SHORT WINGED SCAVENGER-BEETLES.

Putrivora brevipennata. BRACHELYTRA, Latreille.

This tribe embraces an extensive series of beetles, corresponding, for the most part, to the Linnæan genus *Staphylinus*, sometimes called in English *Rove-beetles*, and readily distinguished from all other Coleoptera by their very short wing-cases, which usually cover less than half of the abdomen. The insects of some other families, as we have seen, have their elytra shortened or *truncated* at the end, but in these they always cover more than half of the abdomen, and usually leave only the tip exposed. The Staphylini have narrow, elongated and somewhat flattened bodies. The antennæ are rather short, sometimes of equal thickness throughout, but usually a little larger at the end, and composed of short, roundish or lenticular joints. The mandibles are long, sharp and sickle-shaped, and usually cross each other at the tip when at rest. The abdomen often terminates in two little finger-like bristly processes, between which is a third and shorter one. The anterior tarsi of the males are often dilated. They are also distinguished by the great length of the coxæ or basal joints of their anterior legs. They usually turn up the end of their long flexible abdomen whilst running, and also use it in packing their wings under their short wing-covers. These insects are generally found on the ground, under stones and amongst rubbish. They usually subsist upon decomposing matter, both animal and vegetable, but mostly the latter. They constitute an extensive army of useful scavengers, second in number only to the Necrophaga or club-horned scavengers, of which we have just been treating. But some of the larger species are known to be eminently predaceous, especially in the larva state, voraciously seizing whatever insects come in their way, not even sparing their own species, and some of the small species found on flowers have been observed to have similarly carnivorous tastes. Indeed, their long, sharp, sickle-shaped mandibles, and the large protuberant eyes of a portion of them, would seem to indicate a more generally carnivorous habit than has generally been attributed to them. Others have been found in ants' nests, and are supposed to be parasitic; and a species of Aleochara is an internal parasite, having been reared from the pupæ of *Anthomyia brassicæ*. (Am. Ent. 11, 370.) The larvæ, with the exception of the absence of wings, bear a general resemblance to the perfect insects, both in structure and habits, and are found in the same situations.

The tribe is composed of two families, the long bodied species or Staphylinidæ, and the minute short bodied species, which constitute the family of Pselaphidæ.

Family XXIII. STAPHYLINIDÆ.

The original meaning and application of the generic term Staphylinus are not now known with certainty, but it was applied by Linnæus to the tribe of short-winged Coleoptera. The leading characters of this family have been given in treating of the tribe to which it belongs, and of which it constitutes much the larger part. We will here define the principal sections or sub-families into which it has been divided. Modern authors divide the family into eleven sub-families, but seven of these contain all but a few rare or exotic species.

The following table exhibits the most conspicuous of their distinctive characters:

A. Body narrow and elongated. Elytra (except in the Tachyporides) covering less than half of the abdomen. No ocelli.

B. Head as wide, at least, as the thorax, and usually attached to it by a short neck.

C. Labrum bilobed. Antennæ inserted upon the anterior edge of the front. Size often large ....STAPHYLINIDES.

C C. Labrum usually entire. Antennæ inserted at the sides of the front. Size moderate or small.

D. Maxillary palpi short. Posterior coxæ wide. Tibæ usually spinous on the outer edge. Tarsi usually three-jointed. Abdomen parallel. OXYTELIDES.

D D. Maxillary palpi long and clavate. Posterior coxæ much longer than wide. Tarsi usually five, sometimes four-jointed. Abdomen more or less tapering.

E. Anterior coxæ large. Eyes not prominent ....PEDERIDES.

E E. Anterior coxæ small. Eyes large and prominent ....STENIDES.

B B. Head narrower than the thorax, and more or less inserted in it, often imperfectly visible from above.

F. Body depressed, of equal width and obtuse. Elytra usually covering a third or less of the abdomen ....................ALEOCHARIDES.

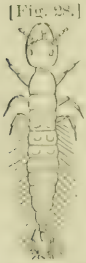
F F. Body convex, conical and pointed behind. Elytra sometimes covering half or more than half of the abdomen .....TACHYPORIDES.

A A. Body broad and depressed. Elytra usually covering half or more than half of the abdomen. Two ocelli on the vertex. Size small...........OMALIIDES.

Sub-family STAPYLINIDES.

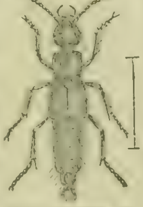
This group stands at the head of the family containing all the large species, sometimes exceeding an inch in length, though some of the genera also contain small species. Its two most distinctive characters are those given in the table. The antennæ are inserted upon the epistoma, which is the ridge which borders the face below, just above the mouth. In the other groups of this family the antennæ are inserted above the epistoma, at the sides of the face, and are usually covered at the base by a little prominence. The species are usually found amongst rubbish, or under dead leaves or stones. They have been supposed to be mostly rypophagous, but some of them are known to be eminently predaceous.

[Fig. 28.]



Larva of GOERIUS OLENS:—after Westwood.

[Fig. 29.]



PHILONTHUS APICALIS, Say:—after Riley.

More than a hundred N. A. species have been described.

A. Antennæ inserted wide apart, at the extremities of the epistoma.
  B. Palpi not enlarged at tip.
    C. Size large, from half an inch to an inch or more in length. Surface pubescent, (except ocypus)
      D. Head of males large, wider than thorax; middle coxæ wide apart.
        E. Antennæ sub-clavate; abdomen as wide as elytra..........................CREOPHYLUS.
        E E. Antennæ filiform; abdomen narrower than elytra......................LEISTOTROPHUS.
      D D. Head of males not enlarged; middle coxæ approximate.
        F. Form slightly tapering; brown or dull black..................................STAPHYLINUS.
        F F. Form elongate, parallel; shining black..OCYPUS.
    C C. Size small, usually less than half an inch in length; shining black, sometimes tinted with red ....PHILONTHUS.
  B B. Labial palpi terminated with a large semilunar joint; head of males enlarged; middle coxæ very wide apart. Size below medium; glabrous....................................OXYPORUS.
A A. Antennæ approximate, inserted on the middle of the epistoma; head oblong, sub-quadrate. Length usually a quarter of an inch or less, elytra often reddish................XANTHOLINUS.

Creophilus, Stephens, contains two N. A. species, one of which, the *C. villosus*, Grav., is not uncommon. It is a robust species, about seven-tenths of an inch long, black, with a broad ash-colored band across the elytra, and another across the abdomen, composed of short hairs. The specific name *villosus—hairy*, is expressive of this character. The generic name means a *lover of flesh*. *Leistotrophus*, Perty, a name expressive of the ferocious character of the species, contains but one N. A. species, *L. cingulatus*, Grav. It is of about the same size as the preceding, of a grayish-brown color, indistinctly spotted with black. The end of the abdomen has a golden luster. Twenty-one species of *Staphylinus* proper are enumerated in Dr. LeConte's catalogue of 1863. One of the largest and most common species is the *S. maculosus*, Grav., eight or nine-tenths of an inch long, of a dark cinnamon-brown color, with a black scutellum, and a row of obscure square blackish spots along the middle of the abdomen. A somewhat similar but rarer and more elegant species is the *S. vulpinus* or *fox-colored* Staphylinus of Nordman. In this the colors are brighter, and the abdomen is black, tipped with fulvous, with golden incissions, and two cinereous pubescent spots at the base of each segment. The *S. cinnamopterus*, Grav., is also cinnamon-colored, with the abdomen nearly black; but it is a smaller species, being but half an inch, or a little more, in length. *S. tomentosus*, Grav., is six-tenths of an inch long, and of a deep, dull black color. *S. violaceous* is of about the same size, also black, but with the thorax and elytra of a rich violet hue. The abdomen is varied along the margin with a silken ash-colored pubescence.

Ocypus, Kirby, meaning *swift-footed*, contains but one species, the *O. ater*, Erichs., seven-tenths of an inch long. *Philonthus*, Curtis, meaning a *lover of dung*, contains many species, a few of which exceed half an inch in length; but most of them range from two to three-tenths of an inch. A considerable number of our species are arranged under the genus *Quedius*, of Stephens, which is closely allied to Philonthus, but differs in having the thorax with a sharp simple margin, and a fe large scattered punctures, whilst in Philonthus the thorax is finely grooved along the edge, and the punctures, also large and few, are arranged in longitudinal rows. The genus *Oxyporus*, Fab., occupies an intermediate position between this sub-family and the Oxytelides, and is placed in the latter by some authors; but Lacordaire retains it in the present sub-family, the essential characters of which it possesses. The species are not large, but they are unusually broad and robust, and are most readily distinguished by their stout mandibles, which project directly forward, and are crossed at the tip when at rest. The species vary from a quarter to nearly a half an inch in length. They are found in fungi upon trees. *O. rufipennis*, Lec., varies from less than three to more than four-tenths of an inch in length, glossy black, with light reddish-yellow elytra, slightly tipped with black at their outer angles. *O. femoralis*, Grav., between three and four-tenths of an inch; black or brown, with pale dull flaxen-yellow elytra, more broadly tipped with black at the outer angles. *O. vittatus*, Grav., very much like the last, but smaller. *O. 5-maculatus* (Melsh.) Lec., between three and four-tenths of an inch; bright tawny-yellow, with black spots, as follows: one on the vertex, one on each side of the thorax, one covering the outer angle of each elytron, and one on the top of each abdominal segment, the two posterior of which are widened into bands. The females are almost wholly yellow, but the outer angles of the elytra are always black. *O. stygicus*, Say, three-tenths of an inch, body wholly black, labrum, base of antennæ, and tarsi reddish. Two other species, the *major* and the *lateralis*, Grav., I have not seen. *Xantholinus*, Serv., the name indicating the reddish-yellow color of most of the species, contains a moderate number of species, which do not vary much from a quarter of an inch in length. In color and general aspect they are liable to be confounded with some of the species of Cryptobium and Lathrobium, in the sub-family of Pederides; but we shall point out the distinctions when we come to speak of those genera.

Sub-family OXYTELIDES.

A small group founded upon the genus *Oxytelus*, Grav. Their most distinctive character is the row of spines on the outer edge of the anterior, and sometimes also the middle tibiæ. Their antennæ are slightly thickened toward the tip, and the abdomen is parallel and usually obtuse or rounded at the end, but with the terminal segment abruptly narrowed, forming a small point, to which the name *Oxytelus*, meaning a *pointed end*, probably refers. These two characters also serve to distinguish them from most of the Staphylinidæ, except the Aleocharides, and from these they are distinguished by their free heads, which are as wide as the thorax. But their most abnormal character is their usually three-jointed tarsi, the last joint being as long as the others united. The species are all small, rarely exceeding a quarter of an inch in length, and sometimes being less than a tenth. The spines or teeth on their anterior tibiæ indicate their fossorial habits, and accordingly they are usually found burrowing into manure or under the bark of decayed trees. Mr. Westwood refers to a species of Bledius which is sometimes found in great profusion, burrowing into the sand on the sea shore below high water mark, and where consequently they must often be submerged by the tide.

Most of our species, upwards of forty in number, are included in the three following genera; the first of which, however, contains but a single species:

A. Abdomen without a margin; tarsi five jointed. Size rather large........................OSORIUS.
A A. Abdomen margined; tarsi three jointed; size small.
  B. Anterior tibiæ with two rows of spines; body cylindrical..............................BLEDIUS.
  B B. Anterior tibiæ with one row of spines; body depressed..............................OXYTELUS.

Sub-family PEDERIDES.

The species of this group are distinguished by their long clavate palpi, the last joint but one being larger than the others, but the last joint of all being small and contracted. As a general rule the species are more elongated and slender than in the other sub-families, and their colors are more various. Their length varies from a half to less than a quarter of an inch. They are found mostly in wet places, and are very rapid in their motions. Upwards of sixty N. A. species have been described. The following are the principal genera:

A. Antennæ strongly geniculate, and bristly; size rather large; color black, often strongly tinted with red..............................CRYPTOBIUM.
A A. Antennæ not geniculate.
  B. Head attached to thorax by a neck of ordinary width; size moderate.
    C. Tarsi simple; color black, sometimes slightly tinted with red....................LATHROBIUM.
    C C. Penultimate joint of tarsi slightly bilobed; orange red, with head and tip of abdomen black; elytra blue..............................PEDERUS.
  B B. Head attached by a very narrow neck, (except Palaminus); size small, length less than a quarter of an inch.
    D. Body of ordinary form, color blackish.
      E. Head square behind..............................LITHOCHARIS.
      E E. Head narrowed behind..............................STILICUS.
    D D. Body very elongate and slender; color wholly or partly yellow.
      F. Head oblong, obtuse, horizontal, pedunculate..............................SUNIUS.
      F F. Head short, transverse, sessile..............................PALAMINUS.

The names *Cryptobium* and *Lathrobium* are expressive of the *concealed modes of life* of these insects under stones or dead leaves, or similar situations. The species of the former genus are usually more, and those of the latter less, than a third of an inch in length; but this rule has a few exceptions. The *C. pusillum*, Lec., is but two-tenths of an inch long, and on the other hand the *L. grande* is four-tenths.

Cryptobium, Mann., is most readily recognized by its strongly geniculate or elbowed antennæ, the first joint being nearly as long as the three following ones united. This character, together with their oblong heads, and reddish coloration, give them a resemblance, as we have above remarked, to Xantholinus, in a former section; and this affinity is increased by the bilobed labrum which occurs exceptionally in this and the following genus. But in Cryptobium the species are usually larger, and the antennæ longer and more strongly elbowed, in addition to the clavate palpi. *Pæderus*, Grav., is at once recognized by the variegated colors as stated in the table. The species are few in number, but one of them, the *P. littorarius*, Grav., is common and widely distributed, being usually found under stones in wet places. The other genera have but three or four known species each. *Stilicus*, Latr., is distinguished by its head narrowed behind, and the ovoid thorax narrowed in front, so that the two parts are united by a mere point, giving to them the aspect of small ants. *Palaminus testaceus*, Erichs., not quite two-tenths of an inch in length, and of a pale yellow color, is not uncommon. They attract attention by their very slender shape and their vermicular or snake-like motions.

Sub-family STENIDES.

This sub-family is composed almost wholly of the genus *Stenus* of Latreille, a word meaning *narrow*, and expressive of their slender form. The species are less than a quarter of an inch in length, of a grayish-black color, and are at once distinguished from all other Staphylinidæ by their large portuberant eyes, which cause the head to be considerably wider than the thorax. The antennæ are small and widened at the tips; the maxillary palpi long and club-shaped, with their first joint unusually elongated; and the ligula or tongue is capable of being remarkably extended. The species are usually found running on mud, or in other wet situations. About two dozen species are enumerated in Dr. Leconte's catalogue—closely resembling each other and distinguished chiefly by the sculpture of the surface. The *S. colon*, Say, is distinguished by a yellow semilunar spot on the middle of each elytron.

Sub-family ALEOCHARIDES.

This sub-family contains a numerous assemblage of small, or very small species, rarely attaining a quarter of an inch in length, and often being less than half that length, and ordinarily of obscure black or brownish colors. Their distinguishing characters are sufficiently stated in the table under the letters B B and F. The antennæ are short, rather robust, usually a little thickened at the end, and are inserted upon the front at the inner margin of the eyes. Their habits are various, some being found under stones or fallen leaves, some in the fungi on trees, and a remarkably large proportion of them in ants' nests. The habit of raising the end of the abdomen whilst running, which is sometimes practiced by the larger Staphylini, is almost universal in this sub-family. A compilation of the descriptions of all the known North American species of this group, amounting to eighty-one in number, is published by Mr. James H. B. Bland, in the fourth volume of the Proc. of the Ent. Soc. of Philadelphia. They are arranged in seventeen genera, many of which contain but one, two, or three species. The following six genera contain a very large proportion of them:

A. Head as wide as the thorax and attached to it by a distinct neck............................FALAGRIA.
A A. Head narrower than thorax and partly immersed in it.
  B. Thorax widely hollowed in front for the reception of the head. Antennæ filiform and longer than to the end of the elytra..ATEMELES.
  B B. Thorax not hollowed in front. Antennæ not nearly reaching the end of the elytra.
    C. All the tarsi five jointed; labial palpi four jointed; length an eighth of an inch or more: ALEOCHARA.
    C C. Anterior tarsi four jointed, the others five jointed; length an eighth of an inch or less.
      D. Labial palpi three jointed; eyes depressed, finely granulated. Color black, or black and brown.
        E. Antennæ slender; abdomen narrowed in front..................................TACHYUSA.
        E E. Antennæ robust; abdomen not narrowed......................................HOMALOTA.
      D D. Labial palpi two jointed; eyes large, convex, coarsely granulated; color black and light yellow..GYROPHÆNA.

The anomalous little genus *Falagria*, Mann. is placed in this sub-family by systematists on account of the position of the antennæ, and the exposed prothoracic spiracle, though it departs widely from it by its large pedunculated head. They are only about a tenth of an inch long, and of a reddish black color. *Atemeles*, Stephens, is of much larger size and still more anomalous, and indeed bears no resemblance to the family of Staphylinidæ except in its shortened wing covers. One North American and three European species are all that are known. They inhabit ants' nests. Our species the *A. cava*, Lec., is nearly a quarter of an inch long, and one-third part as broad, and wholly of a rust-red color. *Aleochara*, Grav., contains a few comparatively large species, being usually nearly or quite two-tenths of an inch in length and of a broad oval form. *Homalota*, Mann, contains a great number of small obscure species, being mostly black, with the elytra often tinted with reddish brown. The little genus *Gyrophæna*, Mann, contains six described N. A. species, none of which exceed one line or one-twelfth of an inch in length. The most common species are light yellow, with the head, a part of the elytra, and the tip of the abdomen black; but some minute species are black varied with reddish-brown. The name *Gyrophæna* comes from the Greek *guros—a circle*, and *phaino*—to *appear* or *resemble*, and alludes to the habits of these little insects of carrying their abdomens forwards on their backs, and at the same time bending their heads under their breasts, so as to resemble a little ball.

Sub-family TACHYPORIDES.

In addition to the characters given in the table, we may add that the tibiæ are strongly beset with spines, which distinguishes them not only from the Aleocharides but from nearly all the species in the other sub-families except the Oxytelides. The abdomen also is often bordered and terminated with divergent spines. The antennæ are inserted under the sides of the face, behind the mandibles, and are generally slightly thickened towards the tip. They are considerably numerous, fifty-seven N. A. species having been described. A few of them are of medium size, but the great majority are considerably less than a quarter of an inch in length. They are usually shining black, with the elytra often tinted with dark red, rarely inclining to yellow, but this is a style of coloration which is very prevalent in the whole family of Staphylinidæ. It has been observed that the species of this sub-family never turn their abdomens upwards, as is so generally done by the Aleocharides and some other Staphylinidæ. They inhabit fungi, boleti, dung and other decayed matter. Some are found under dead bark. The following table exhibits the principal genera into which this group has been divided:

A. Antennæ eleven jointed; tarsi five jointed; size various.
  B. Elytra longer than the thorax, minutely and irregularly punctured.
    C. Abdomen with a narrow margin; surface glabrous.
      D. Body oblong, somewhat depressed, moderately tapering, maxillary palpi filiform; length from one-eighth to more than a quarter of an inch .... TACHINUS.
      D D. Body short, convex, abruptly tapering; maxillary palpi sometimes swollen, subulate or pointed at the end; length less than an eighth of an inch.................... TACHYPORUS.
    C C. Abdomen without a margin; surface finely pubescent, form conical, size small ... CONOSOMA.
  B B. Elytra about as long as thorax; smooth or with three rows of punctures.
      E. Maxillary palpi filiform; length from an eighth to more than a third of an inch: BOLETOBIUS.
      E E. Maxillary palpi swollen, subulate at tip, size small.................... MYCETOPORUS.
A A. Antennæ ten jointed; tarsi four jointed; size extremely small.................... HYPOCYPTUS

Tachinus, Grav., meaning *swift*, and *Boletobius*, Leach, meaning *living* in *boleti*, contain, as seen by the table, all the larger species, but they vary much in size. *Conosoma*, Kraatz, contains but three species, about a tenth of an inch or a little more in length. They resemble Tachyporus in the convex conical shape of the body, but they are finely pubescent or silky on the surface, and the abdomen is rounded at the sides, without the narrow sharp margin which is common to all the other genera. *Mycetoporus*, Mann, is very closely allied to Boletobius, but the species are usually smaller, and more linear in their form. The names of the two genera mean essentially the same thing. *Hypocyptus*, Schup., contains the smallest species in the family of Staphylinidæ, and some of the smallest in the order of Coleoptera, or in the class of insects, being about the twenty-fifth of an inch in length, and some of them not more than a fiftieth. The generic name is derived from the Greek *hupo*—

under, and *kuptos—bent*, in allusion to their habit of bending the head under the body, which, together with their convex form, gives them the appearance of little globes or balls, much like the genus Agathidium referred to above in the family Anisotomidæ, and also like Gyrophæna in the preceding sub-family of Aleocharides, but in the last the effect is produced in a different manner. The genus *Coproporus*, Kraatz, does not seem to be sufficiently distinct from Tachyporus, nor *Byroporus* from Boletobius, to render the formation of these genera necessary.

Sub-family OMALIIDES.

Founded upon the genus *Omalium*, Grav., from the Greek *omalos—level*, on account of the comparatively broad and depressed form of most of the species. Their most essential character is the presence of two ocelli, resembling minute glass beads, on the back part of their heads—a character peculiar to this sub-family, with but two or three known exceptions. But their most conspicuous character is the comparatively greater length of the elytra, which also has a few exceptions. The large depressed elytra give to some of these insects an obvious resemblance to the Nitidulæ, in the preceding tribe; but in these only the tip of the abdomen is usually exposed, and their knobbed antennæ at once distinguish them from any of the Staphylinidæ. The species of the present sub-family are of obscure brown or yellowish colors, and small size, never attaining a quarter of an inch in length, and often being less than an eighth. Their habits are various, some being found in wet places, under stones, or under decayed bark, whilst others are found on plants and flowers, and Mr. Walsh bred some of them from fungi.

Upwards of fifty N. A. species have been described, most of which are contained in the following genera:

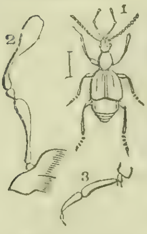
A. Mandibles toothed; head entirely free; thorax heart-shaped, narrow behind.
  B. Last joint of palpi three times as long as the preceding.......................LESTEVA.
  B B. Last joint of palpi not elongated.......................ANTHOPHAGUS.
A A. Mandibles simple; head partly inserted; thorax not narrowed behind.
    C. Hind tarsi moderately elongated; elytra covering the greater part of the abdomen; tibiæ not spinous.......................OLOPHRUM.
    C C. Hind tarsi short, the four first joints combined not longer than the fifth.
      D. Tibiæ finally spinous; elytra covering about half of abdomen.......................OMALIUM.
      D D. Tibiæ not spinous; elytra almost or quite covering abdomen.......................ANTHOBIUM.

Anthophagus, Grav., scarcely differs generically from *Lestera*, Latr.; but their habits are different—the former being found on flowers, and the latter amongst wet herbage, near the water. They are easily distinguished from all other Staphylinidæ by the heart-shaped thorax, which, together with the free head and prominent eyes, gives them a remarkable resemblance to some of the smaller Carabidæ. There is a small yellowish species in the Walsh cabinet, labeled "*Anthobium protectum*, LeC., from Mass.," in which the abdomen is completely covered by the elytra.

Family XXIV. PSELAPHIDÆ.

This is a family of minute beetles, generally less than a tenth of an inch in length, and is founded upon the genus Pselaphus, of Herbst, a term derived from the Greek *pselaphus—to feel*, in allusion to the greatly developed palpi or feelers. They are found in the same situations as the Staphylinidæ, and resemble them in the shortness of the elytra, which usually cover only about half of the abdomen. In their form, however, they are wholly different, being short thick-bodied beetles, with the abdomen much larger than the thorax. The antennæ are clavate or capitate, and the maxillary palpi are very long and clavate, often equalling the antennæ in length. The tarsi are apparently two-jointed, but really three-jointed, the first joint being very small. Like some of the larger Staphylinidæ, these very small insects are predaceous in their habits, subsisting upon acari and other minute animals. Some of them are found in ants' nests. A synopsis of the Pselaphidæ of the United States is given by Dr. E. Brendel, in the sixth volume of the Proceedings of the Ent. Soc. of Philadelphia, where eighty species are briefly described.

[Fig. 30.]



Pselaphus:—1, beetle; 2, maxillary palpus; 3, tarsus, showing minute basal articulation, all magnified—after Westw.

Fourth Sub-section. PECTINICORNES.

Antennæ pectinate or comb-toothed; subsist mostly upon the sap of trees.

Tribe VI.

STAG-BEETLES.

This sub-division and tribe are composed of the single family of Lucanidæ or Stag-beetles, distinguished by their pectinate or comb-toothed antennæ, which are also strongly geniculate or elbowed; by the projecting mandibles, which, in the males, are often enormously developed and branched, from which these insects have received their common name of Stag-beetles; and by their size, which is never below the medium, and is generally large or very large, some species being upwards of two inches in length, including the mandibles.

These insects are closely allied to the Lamellicorn beetles which follow, and are considered by many authors as holding the rank of only a sub-division or family of the latter. Most modern authors, however, treat them separately. The principal differences may be expressed as follows:

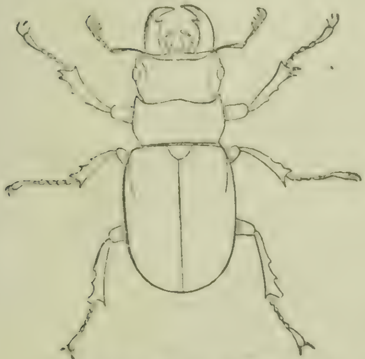
Pectinicornes. Antennæ elbowed, the club composed of fixed transverse teeth. Mandibles of the males often greatly developed. The nervous ganglia distributed through the abdomen as well as the thorax. Larvæ without transverse wrinkles upon the segments; anal opening lengthwise.

Lamellicornes. Antennæ not elbowed, the club composed of moveable plates. Mandibles of the males not remarkably developed. Nervous ganglia consolidated in the thorax. Larvæ with transverse wrinkles upon the segments. Anal opening crosswise, except in the sub-family of Passalides.

We have the more readily adopted this separate classification of these insects as it enables us to discard the discordant element of Lucanidæ from the otherwise comparatively homogeneous group of lamellicorn beetles, with neither of the two great tribes of which can they be made to harmonize.

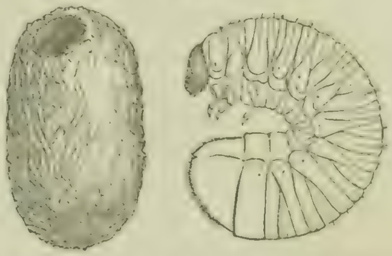
Family XXV. LUCANIDÆ.

[Fig. 31.]



LUCANUS DAMA, Fabr.:—after Packard.

[Fig. 32.]



LUCANAS DAMA, Fabr.:—larvæ and cocoon—after Pack

The characters of this family have been given above sufficiently for their recognition. Notwithstanding their conspicuous size, but little is known of the habits of the perfect insects. The few observations on record go to show that their ordinary food consists of honey dew, or the exudations of the leaves and bark of trees, which last they are said to pierce with their pincer-like mandibles, but the force with which these organs are brought together does not seem to be sufficient for this purpose. They have been known to feed readily, in confinement, upon moistened sugar. The larvæ are found in rotton wood, and some of them have been known to bore into the solid roots of trees. But in this country they have never been known to be seriously injurious.

A. Ligula elongated and attached to the anterior face of the mentum; antennæ usually elbowed; first joint nearly or quite as long as all the others united; abdomen moderately pedunculated; scutellum normal and distinct.
  B. Body moderately convex; head unarmed, and in the males nearly or quite as wide as the thorax; club of antennæ 4-jointed with the first joint small.
    C. Antennæ geniculate or elbowed; anterior coxæ approximate.
      D. Mandibles pointed; eyes notched by the margin of the head.
        E. Elytra smooth, slightly curved at the sides; size very large...LUCANUS.
        E E. Elytra striate and punctate; sides parallel; size above medium. DORCUS.
      D D. Mandibles thickened, obtuse, and many toothed at the end; eyes scarcely notched; size medium ....PLATYCERUS.

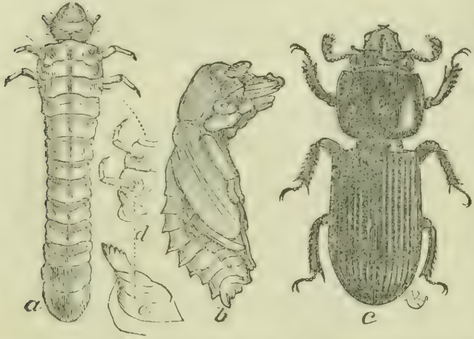
C C. Antennæ not geniculate; anterior coxæ contiguous; size medium. CERUCHUS.

B B. Body cylindrical; head much narrower than the thorax, and prolonged into a horn in the male, and tubercled in the female; size medium. SINODENDRON.

A A. Ligula broad, and filling the quadrangular notch of the mentum; antennæ not elbowed, first joint moderate; scutellum broad but indistinct, situated on the peduncle; elytra parallel and deeply furrowed. Size very large. PASSALUS.

Lucanus contains three N. American species; the *L. elaphus*, a Southern species, the male varying in length from one and a half to more than two inches, with large branching mandibles, larger than the head and thorax; *L. dama*, our common *pinching beetle*, of a mahogany-brown color, and from an inch to an inch and a half long; and the *L. placidus*, an inch long, almost black, with the tooth of the mandibles bifid at the tip. *Dorcus* has but one generally known species, the *parallelus*, of Say, brownish-black, and eight or nine-tenths of an inch in length. The *Platycerus quercus*, four-tenths of an inch long, of a brownish-black color, is a widely distributed, but nowhere a common species. *Ceruchus piceus*, dark brown, and half an inch long, is occasionally found in considerable numbers in rotten wood. *Sinodendron* is not known east of the Rocky Mountains. *Passalus cornutus*, a large, oblong, depressed beetle, an inch and a quarter long, of a shining black color, sometimes with a dark-reddish tint, and with a short horn bent forwards, on the top of the head, is not an uncommon insect about the roots of decayed stumps and other similar situations. The genus Passalus contains many species, most of which inhabit S. America, but the *P. cornutus* is the only species found in the United States.

[Fig. 33.]



PASSALUS CORNUTUS:—*a*, larva; *b*, pupa; *c*, beetle; *d*, underside of thoracic joints, showing atrophied hind leg of larva; *c*, same enlarged—after Riley.

Meaning of generic terms:

Lucanus—the stag, alluding to the large branching mandibles of some of the males.

Dorcus—the antelope. The males of some foreign species have large toothed mandibles.

Platycerus—having *wide antennæ.*

Ceruchus—bearing a horn.

Sinodendron—injuring trees.

Passalus—a post or peg, referring to the horn on the head of some species.

Fifth Sub-section, LAMELLICORNES.

Antennæ lamellate. Habits of the two tribes different.

This is the extensive and natural group of Coleopterous insects, generally known by their scientific name of Lamellicornes, or Lamellicorn-beetles, and so called from the peculiar construction of their antennæ, which terminate in a club formed of moveable plates or leaves, which, with a few exceptions, are three in number. In some of the insects of the Clavicorn division, the club of the antenna is also composed of thin flat joints, constituting what is known as the perfoliate antenna, but here the axis of the antenna passes through the plates, which are immovable; but in the lamellate antenna, the plates are attached to the axis by only one of their sides, which leaves them free to open and shut like the leaves of a book. These plates are sometimes thin and similar; sometimes the first is thick and hollowed out to receive the other two, and sometimes the two outer ones are thickened and enclose the intermediate one. In the dead specimen these plates are generally closed together. One of the most conspicuous and invariable characters of the family is the form of the anterior tibiæ which are constructed for digging in the ground, being broad and compressed, and strongly toothed and scalloped on their outer edge.

The larvæ are white, six-footed grubs, some of which are found in manure and others in rotten wood. A few of the larger species have been seriously injurious, both in Europe and in this country, by feeding upon the roots of grasses and other plants. They are usually seen lying upon one side in a curved position. They are gross feeders, and the hinder part of their bodies is usually filled with black excrementitious matter, which is partially visible through the semi-transparent walls of the abdomen.

The common *white grub*, which is the larva of the May-beetle, is a familiar example of these larvæ.

With respect to their food habits these insects are divided into two large, somewhat equal, and well marked tribes. They were all included by Linnæus in his genus Scarabæus.

Tribe 1st (or 7th of the whole series), *Excrementivora*. Elytra (except in the first family), covering the whole of the abdomen. Legs stout, the hind legs set far back, behind the middle of the hind-body. Live upon putrescent or decomposing matters, chiefly the excrement of animals.

Families: Copridæ, Aphodiidæ, Geotrupidæ and Trogidæ.

Tribe 2d (or 8th), *Herbivora*. Tip of the abdomen always exposed. Legs (except in the Dynastidæ) rather slender, and with the hind legs attached at or before the middle of the hind body. Live upon fresh vegetable food, either leaves or flowers.

Families: Dynastidæ, Rutelidæ, Melolonthidæ and Cetoniidæ.

TRIBE VII.

LAMELLICORN DUNG-BEETLES.

Excrementivora lamellicornia. SAPROPHAGA, MacLeay.

These beetles, as their name implies, are found almost exclusively in the dung of animals, mostly that of horses and cows, upon which they feed, and the decomposition of which they hasten, and thus constitute an important wing of the great army of useful insect scavengers. The tribe is composed of the four following families:

A. End of the abdomen exposed. Middle legs wider apart than the others; hind tibiæ with a single spur; antennæ 8 or 9-jointed; size various......COPRIDÆ.

A A. Abdomen wholly covered by elytra. Middle legs not wider apart than the others; hind tibiæ with two spurs; antennæ 9 to 11-jointed.

  B. Abdomen with six ventral segments. Anterior thighs not dilated.

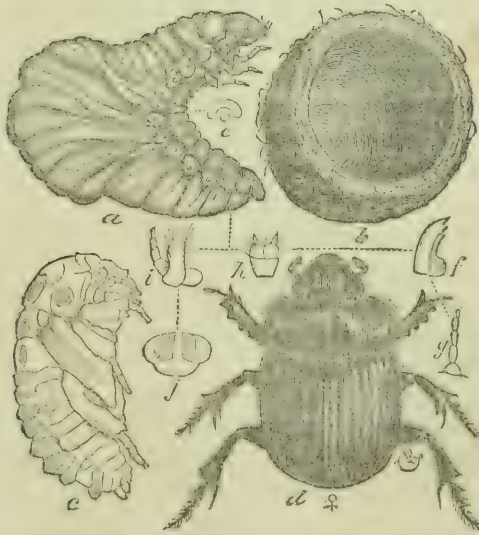
    C. Antennæ 9-jointed. Body almost cylindrical; size small......APHODIIDÆ.

    C C. Antennæ 11-jointed. Mandibles robust and exposed; body oval or rounded; size various..GEOTRUPIDÆ.

  B B. Abdomen with five ventral segments. Anterior thighs greatly dilated; body rough; size small to medium ... .TROGIDÆ.

Sub-family XXVI. COPRIDÆ.

[Fig. 34.]



COPRIS CAROLINA, Linn.:—*a*, larval; *b*, a section of the hollow excrementitious ball in which the insect undergoes its transformations; *c*, pupa of C. MARGINATUS (from Dehaan); *d*, female beetle; *e*, the spiracle, or breathing pore of larva; *f*, the mandible; *g*, the antennæ; *h*, the labium, with the rudimentary labial palpi; *i*, the maxilla and maxillary palpus; *j*, the swelling on the under side of the anal segment—after Riley.

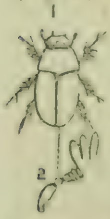
This family contains the largest species in this tribe of Lamellicorns, the *Copris Carolina* being upwards of an inch in length, two-thirds of an inch in width, and half an inch in thickness. But it also contains small species. The *Chœridium capistratum*, a shining, mahogany-brown insect, is scarcely a quarter of an inch in length, and some of the Onthophagi are still smaller. Many of the males have a horn or tubercle on the top of the head. In this division is the common tumble-dung beetle, (*Canthon lævis*, Drury.) A pair of these insects is often seen working in concert, and rolling a ball of manure in search of some suitable place in which to bury it. Mr. Riley informs me that the common notion that the egg is rolled up in the center of this ball is an erroneous one, and that the egg is in reality deposited in a cavity at one side, made for the purpose after the ball is sunk. The young feed upon the half decomposed matter of which the ball is composed. The species are generally black, but some have rich metallic hues. The *Copris* (*Phanæus*) *carnifex*, with its tints of burnished copper and green, is one of our richest insects.

A. Middle and hind tibiæ slender. Size medium; color black..........................CANTHON, 17 sp.
A A. Middle and hind tibiæ enlarged at the end.
  B. Labial palpi 3-jointed.
    C. Anterior coxæ strongly tranverse and depressed. Size small; color brown.....CHŒRIDIUM, 3.
    C C. Anterior coxæ large, conical and prominent. Size large or medium; color black or metallic: COPRIS, 10.
  B B. Labial palpi 2-jointed. Anterior coxæ large and conical; size small; color black: ONTHOPHAGUS, 10.

Family XXVII. APHODIIDÆ.

These are small beetles found in great abundance in the fresh manure of horses and cows, into which they burrow almost as soon as dropped from the animals. They never much exceed a quarter of an inch in length, and are usually black, but sometimes with red or brown elytra. Nearly a hundred N. A. species have been described, and divided into a number of sub-genera, but they may all be included in the genus *Aphodius* of Illiger.

[Fig. 35.]



Aphodius. 1. beetle. 2. antenna—after Westwood.

The following are among our most common species: The *A. fimetarius*, Fab., nearly three-tenths of an inch long; head and thorax shining black, and elytra red; the *A. oblongus*, Say, is equally long, rather more slender, and wholly black; the *A. terminalis* is less than two-tenths of an inch long, black with the tip of the elytra and legs reddish; the *A. serval*, Say, is of the same size, black, with the elytra dirty white, with three sub-quadrate black spots and a lateral double or triple irregular interrupted black stripe on each.

Family XXVIII. GEOTRUPIDÆ.

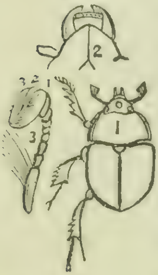
These are distinguished from the two preceding families by their robust horny mandibles which project visibly beyond the upper lip. Their average size is above medium, but the Bolboceri fall considerably below it. The Geotrupes (more correctly spelled Geotrypes) are very common insects, found under cow-dung in pastures, often burrowing into the ground beneath.

—11

The following are the two principal genera:

A. Club of antennæ small with the plates of equal thickness; size medium or above; color dark metallic green or purple, sometimes black.........GEOTRYPES, 7.
A A. Club of antennæ large and compact with the plates of unequal thickness; size below medium; color brown.........BOLBOCERUS, 3.

[Fig. 36.]



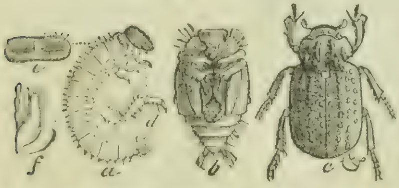
GEOTRUPES: — 1, beetle; 2, mandibles; 3, antenna, showing the large 3-jointed subglobose club, and how the middle joint is encased in the preceding—after Westwood.

The *G. splendidus*, Fab., is our most common species, usually about seven-tenths of an inch long, but varying considerably in size, and varying also in color from dark metallic green to purple. *G. excrementi*, Say, is a little more than five-tenths of an inch in length, and of a bronze-black color. *G. opacus*, Hald., is of a deep black color, and varies in length from a little below to a little above half an inch; it is much rarer than the other two species. The elytra are not furrowed like the others, but only marked with lines of minute punctures. The *Bolbocerus farctus*, Panzer, is half an inch long, brownish-yellow, with the hind margin of the thorax, the sutural line, and the broad tips of the elytra black. *B. Lazarus*, Panzer, is four-tenths of an inch long, and wholly of a mahogany-brown color. *B. filicornis*, Say, three-tenths of an inch long, of the same color as the last, and distinguished by a slender horn on the top of the head of the males, whilst the others have only tubercles. The last species has been separated from the others under the generic name of *Odontæus*. It is also distinguished by having the eyes completely divided by the lateral margins of the head.

Family XXIX. TROGIDÆ.

These insects are readily distinguished by their coarsely pitted thorax and ridged elytra. The other characters given in the foregoing table are also very distinctive. They vary in size from more than a half to less than a quarter of an inch in length, and are of a uniform slate-black, or brownish-black color. Their habits are but little known, but they are usually found in sandy situations, and sometimes upon the carcasses of dead animals. Mr. Riley breeds *Trox pustulatus* (Fig. 37.) from dead chickens. They are comparatively rare insects. They are somewhat numerous in species, but are all included in the genus *Trox* of Fabricius.

[Fig. 37.]



TROX PUSTULATUS, LeC.:—*a*, larva; *b*, pupa; *c*, beetle; *d*, *e*, *f*, leg, cervical plate, and maxilla, with palpi of larva enlarged—after Riley.

The following three species may be taken as representatives of the genus: *Trox porcatus*, Say, nearly half an inch long, the elytra with elevated, interrupted lines, and numerous transverse punctures on the interstitial spaces: *T. terrestris*, not quite quarter of an inch in length, the elytra with raised obtuse lines on which are little fascicles of short hairs; and *T. striatulus*, only three-twentieths of an inch in length, with regular grooves between the ridges on the elytra.

TRIBE VIII.

LEAF-CHAFERS.

Herbivora lamellicornia. THALEROPHAGA, MacLeay.

The Chafers, or leaf-eating lamellicorns, are easily distinguished from the Dung beetles, by the tips of their abdomens being always uncovered by the wing-cases, by their usually more slender legs, and by their lighter and often variegated colors. As we have seen above that the Cicindelidæ represent the lion and tiger amongst the higher animals, so the present tribe may be regarded as representatives of the ruminating quadrupeds, being, as a general rule, the most bulky of coleopterous insects, and exclusively vegetable feeders.

They generally feed, when in the beetle state, upon the leaves of trees, but many of the smaller species devour the petals and pollen of flowers. The Anomalæ are particularly destructive to the foliage of the grapevine.

The larvæ are found partly in rotten wood and partly in the earth, where they feed upon the roots of grasses and other plants. The common *white grub* furnishes a familiar example.

Like the preceding tribe, they comprise four families, which can usually be distinguished by their general aspect and coloration, but which exhibit but few distinctive organic characters.

They may be tabulated thus:

A. Head or thorax, or both, almost always armed with one or two horns or tubercles; upper lip concealed beneath the clypeus, which is not separated from the front by a suture. Size generally large, or very large; color often black or blackish:

DYNASTIDÆ.

A A. Head and thorax unarmed; labrum often partially visible in front of the clypeus, which is separated from the front by a transverse suture, (except Cetoniidæ.) Size various; color never black, (except in a few Cetoniidæ.)

B. Tarsal claws bifid, (except Hoplia); color usually uniformly brown, sometimes varied with patches of whitish hairs or scales; the rows of abdominal spiracles nearly parallel: MELOLONTHIDÆ.

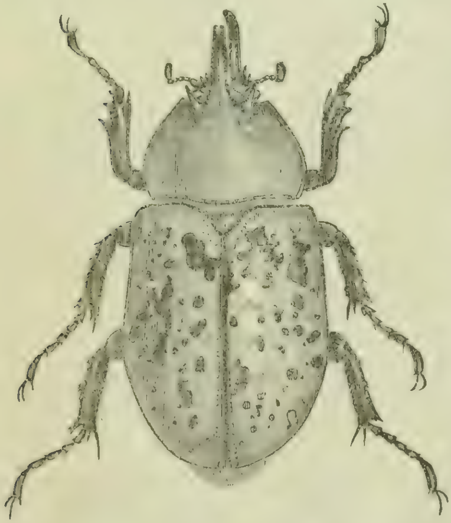
B B. Tarsal claws simple; abdominal spiracles strongly divergent posteriorly; colors usually beautiful and often variegated.

C. Tarsal claws unequal; anterior coxæ transversal and usually depressed; scutellum usually rounded behind: RUTELIDÆ.

C C. Tarsal claws equal; anterior coxæ conical and prominent; scutellum usually triangular and pointed...CETONIIDÆ.

Family XXX. DYNASTIDÆ.

[Fig. 38.]



DYNASTES TITYUS, Linn.:—after Riley.

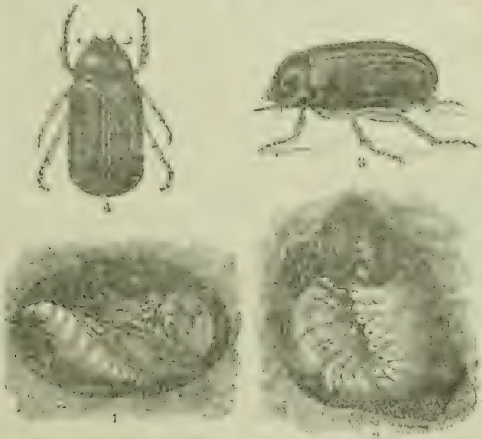
This name has the same origin as the English word *dynasty*, which means *sovereignty*, and it has been given to these beetles on account of their generally large size and imposing aspect. The family contains the largest insects in the order of Coleoptera, some of the tropical species being more than two inches and a half long, and more than an inch in thickness. We have one species in the Southern States, the *Dynastes Tityus*, Linn. (Fig. 38), which is two inches long, of a greenish-gray color, with scattered black spots; there is a long horn on the head and another on the thorax, with a smaller one each side of it; the female has only a tubercle on the head. Another species, the *Xyloryctes satyrus*, Fab., an inch or more in length and of a black color, and with an upright horn on the head of the male, is not uncommon in the Northern and Middle States. Its larvæ are sometimes injurious to ash trees by feeding upon their roots.

In the genus *Ligyrus*, Burm., the head has two very small tubercles, and the general aspect is much like the common chafers, but they are distinguished at once by their black color. The *L. relictus*, Say, is a very common species. It is three-quarters of an inch long; its larva is one of the *white grubs*, and is often found in old rotted manure. *Cyclocephala*, Latr., forms a connecting link between this family and the Rutelidæ, all the species being of medium size, of a light-yellowish color, and with the head and thorax wholly unarmed. In its general aspect, therefore, it resembles the latter; but it wants the inequality of the tarsal claws, which is the most distinctive character of the Rutelidæ, whilst the clypeus is almost consolidated with the front, and the labrum is hidden beneath it as in the Dynastidæ.

Family XXXI. MELOLONTHIDÆ.

This is much the most numerous family of Lamellicorns in the North American fauna. They can be easily distinguished, for the most part, by their oblong, somewhat cylindrical form, their uniformly brown color, and by the hooks of the tarsi, which are of equal length, and bifid or forked at the extremity. The genus Melolontha proper, (Polyphylla, Harris,) differs from all our other Lamellicorns in having seven leafets in the club of the antennæ of the males, and five in those of the females, whilst almost all Lamellicorns have but three in both sexes. They also differ from the majority of Melolonthides in being ornamented with spots or stripes which are produced by prostrate white hairs. The species of the genus Hoplia are also variegated with patches of minute white scales; and Macrodactylus, with scales of an ochreous color. The bifid tips of the hooks at the end of the tarsi can be easily seen with a simple lens, and furnish one of the most distinctive characters of this sub-family. The tarsal hooks of Hoplia, however, are anomalous. The hind feet have but a single hook which is generally entire: in the four anterior feet the hooks are double as usual, but unequal, the outer one being larger and bifid at the tips. This genus is also peculiar in having but one spur at the end of the tibiæ. The remarkable genus *Lichnanthe* is regarded by some as forming the type of a distinct sub-family.

[Fig. 39.]



PHYLLOPHAGA (LACHNOSTERNA) FUSCA, Frohl: QUERCINA, Knn.—1, pupa in its earthen cell; 2, larva; 3, 4, beetle, side and back views (after Riley).

The following table shows the principal N. American genera of Melolonthides, east of the Rocky Mountains :

A. Elytra narrowed and sometimes separate at their tips ; tarsal claws equal and simple ; whole body, except elytra, covered with long dense hairs..Lichnanthe, 4.
A A. Elytra not dehiscent ; some or all of the tarsal claws bifid ; body not conspicuously hairy.
  B. Tibiæ with one spur, and hind tarsi with a single entire claw...................... ......Hoplia, 11.
  B B. Tibiæ with two spurs ; all the tarsi with two bifid claws.
    C. Club of antennæ with seven leafets in the male and six in the female ; body spotted or striped with short, prostrate, whitish hairs..Polyphylla, 7.
    C C. Club of antennæ with 3 leafets ; color generally uniform.
      D. Claws chelate or capable of being folded down upon the last tarsal joint, minutely cleft at the end, the teeth lying side by side ; body parallel and depressed...Dichelonycha, 14.
      D D. Claws not chelate, strongly bifid, one tooth above the other ; body convex.
        E. Anterior coxæ not prominent ; ventral segments soldered together with their sutures indistinct ; medium or large insects, usually more than half an inch in length : Phyllophaga, 66.
        E E. Anterior coxæ elongated and prominent ; ventral segments distinct ; small species ; less than half an inch in length.
          F. Body densely clothed with ochreous scales ; tarsi very long ....Macrodactylus, 3
          F F. Body usually clothed with a fine silken pubescense ; ventral segments six ; hind coxæ very broad...Serica, 16.
          F F F. Body naked ; glabrous ; ventral segments five ; hind coxæ normal : Diplotaxis, 39.

Lichnanthe vulpina, Hentz, is a little more than half an inch long, and is at once distinguished by its elytra being narrowed and separated at their ends, and by the body being densely clothed with long rust-yellow hairs. It is quite a rare insect.

The *L. lupina*, LeConte, found on the Atlantic coast, is much smaller than the above, and less densely clothed with cinereous hairs. The elytra in this species do not separate at the tip.

The *Hoplia trifasciata*, Say, is about a third of an inch long, reddish brown, and more or less covered with whitish scales, which are so arranged on the elytra as to form three imperfect transverse bands. *H. modesta*, Hald., is smaller and paler, and the clothing of the elytra resembles hairs more than scales. The other species are more rare, and several of them inhabit California. Two species of Polyphylla are found in the Eastern States : *P. occidentalis*, Linn., in the Southern Atlantic States—often more than an inch in length, with the white down on the elytra arranged in regular stripes ; and, *P. variolosa*, Hentz, found in the Middle States, and as far North as Massachusetts—less than an inch in length, and having the elytra irregularly spotted instead of striped. The club of the antennæ is much longer in the males than in the females, a character not peculiar, however, to this genus.

Dichelonycha, Kirby, is composed of a considerable number of small, elongated, depressed species, usually having the elytra more or less tinted with brassy-green, and often requiring a close examination to distinguish one species from another. Our two common species are the *elongata*, Fab., and the *linearis* of Gyllenhal. They differ slightly in color and in the form of the thorax; but as these characters are variable in both species, it would, perhaps, be more correct to regard them only as varieties.

The genus *Phyllophaga*, Harris, (*Lachnosterna*, Hope,) is very numerous in species, many of which, however, bear a close resemblance to each other. It is emphatically, but not exclusively, a North American genus, 66 of the 116 known species being found in this country. They may be divided into five groups, according to the clothing of the body. In the first and most numerous group, of which the common May-beetle, *P. fusca*, may be taken as the type, the upper side is smooth and shining. The second group contains but one species, the *P. lanceolata*, Say, found mostly west of the Mississippi river, and remarkable for having the body clothed with small lance-shaped cinereous scales. In the third group the body is more or less clothed above with soft erect hairs. Two species of this group are common in some localities, the *P. hirticula*, Knoch, and the *L. Georgicana*, of Gyllenhal. In the former the hairs on the elytra are arranged mostly in three rows, whilst in the latter they are equally distributed. The fourth group contains a small number of large species, in which the whole upper surface is densely clothed with short prostrate hairs or down. The *P. ilicis*, Knoch, is the type of this group. The fifth group is composed of comparatively small species, about half an inch in length, of a pale color, partly smooth above, but with the thorax and base of the elytra densely clothed with long hairs. The *P. tristis*, Fab., the same as the *P. pilosicollis*, Knoch, the type of this group, is not uncommon. One other species is found in Texas. There is also a number of small pale species, half an inch or less in length, with the body glabrous, which might constitute a sixth group. The *P. longitarsis*, Say, is the type of this group, remarkable, as its name implies, for the length of the tarsi.

It must be remarked that all the species of this genus are densely hairy on the under side of the breast, as indicated by the generic term *Lachnosterna*, of Hope.

The common Rose-bug, (*M. subspinosus*, Fab.) is the type of the genus *Macrodactylus*, Latr., a word meaning *long tarsus*. The Rose-bug is between three and a half and four-tenths of an inch in length, covered all over with minute ochre-yellow scale-like hairs, which are not distinctly visible without the aid of a magnifier. The thorax is also somewhat densely clothed with short upright hairs. A specimen from Georgia, with the hairs more conspicuous, has been described by Dr. LeConte under the name *setulosus*. Another species, the *angustatus*, Pal. de Beauv., found in the Southern States, is distinguished by its longer thorax, and the absence of the erect hairs. The genus is exclusively

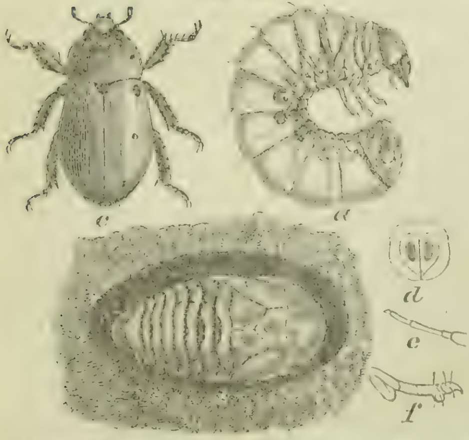
American, but most of the species are found south of the Gulf of Mexico.

The genus Serica is distinguished by the soft silken pubescence with which the body is covered, and which is beautifully iridescent, that is, reflecting the colors of the rainbow. Where this character is deficient, as it is in a few species, they can be readily determined by the remarkable widening of the hind coxæ, which form a broad plate covering the base of the abdomen, and which are at least as wide as any two abdominal segments. The ground color is dark reddish-brown, or almost black. We have three rather common species: the *S. sericea*, Illiger, between three and four tenths of an inch in length, of a dark purple tint; the *S. iricolor*, Say, scarcely three-tenths of an inch long, almost black, and distinguished by the erect hairs with which the thorax is clothed; and the *S. vespertina*, Sch., of the same size as the *sericea*, but destitute of the iridescent pubescence.

Diplotaxis, Kirby, contains a large number of small species, from three to five-tenths of an inch long, and of a reddish brown or black color, and often closely resembling each other. They resemble the genus *serica* in general appearance, but are distinguished by the hind coxæ not being unusually dilated, and the want of pubescence: one species, however, the *sordida*, Say, forms a connecting link, in this respect, by being clothed with erect hairs.

Family XXXII. RUTELIDÆ.

[Fig. 40.]



PELIDNOTA PUNCTATA, Linn.:—*a*, larva; *e*, its antenna; *f*, leg; *d*, tip of abdomen; *b*, pupa, in its cell, the walls of which are composed of particles of wood and excrement; *c*, beetle—after Riley.

The most distinctive characters of the Rutelides are their unequal tarsal claws, and their usually fine or brilliant colors. But our most common species, the Anomalæ, though glabrous, are not brilliant, and might be mistaken for Melolonthæ; but the unequal and uncleft posterior claws readily distinguish them. Most of the insects of this sub-family are tropical. Nineteen N. A. species are known, more than half of which belong to the genus Anomala. This sub-family, like the preceding one, contains a number of species which are seriously injurious to the horticulturist by devouring the leaves of both ornamental and fruit trees, and especially those of the grape vine.

The table of genera is as follows:

A. Elytra with a very narrow membraneous margin. One of the anterior and middle claws cleft. Size below medium.
  B. Elytra strongly furrowed, with a small notch at base. Thorax impressed, and hairy: Strigoderma, 2
  B B. Elytra puncto-striate, and without notch. Thorax plain, and nearly or quite hairless: Anomala, 10
A A. Elytra without membrane. Claws all simple. Size above medium.
  C. Clypeus separated from the front by a distinct suture.................................Cotalpa, 5
  C C. Clypeus not distinct from the front...Pelidnota, 2

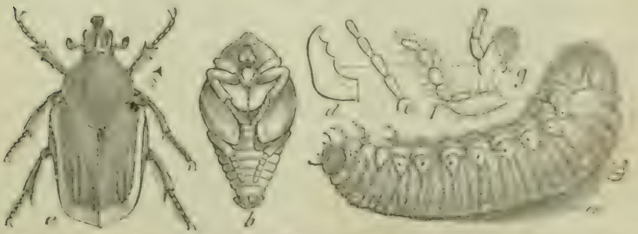
The *Strigoderma arboricola*, Fab., is four-tenths of an inch long; head, disk of thorax, and tip of abdomen blackish; elytra and broad margin of thorax yellowish-brown.

We have two common species of Anomala, the *varians* and the *lucicola*, of Fabricius, which have been much confounded by authors. According to the diagnosis of Burmeister, probably founded, as Dr. Le-Conte suggests, upon the Fabrician types, the species so common on grape vines at the West, having the elytra faintly striate, and spotted with black so as to form two imperfect bands, and with the mesosternum only slightly carinate, is the true *varians* of Fabricius, whilst the *lucicola* has deeply striate elytra without bands, and the mesosternum strongly protuberant. But the *lucicola* usually has the vertex and disc of the thorax black, and individuals of both species sometimes occur which are wholly black.

The type of the genus Cotalpa is the common goldsmith beetle, *Cotalpa lanigera*, of Linnaeus. The *Pelidnota punctata*, Linn., (Fig. 40) is also a large and common species, found feeding upon the leaves of the grape vine. It is nearly an inch long, of a bay color, with three black spots on each wing-cover. Its larva, as Mr. Riley has ascertained, feeds on the decaying roots and stumps of various trees.

Family XXXIII. CETONIIDÆ.

[Fig. 41.]



Gymnetis (Allorhina) nitida, Linn.:—*a*, larva; *b*, pupa; *c*, male beetle; *d*, *e*, *f*, *g*, mandible, antenna, leg and maxillary palpus of larva—after Riley.

In addition to the characters given in the table of families, the Cetoniidæ are distinguished by being somewhat flattened, or nearly level on the back, whilst the Lamellicorns generally are regularly convex; the elytra are a little narrower at the tip than at the base, and in the Cetoniides proper the side pieces of the mesothorax are continued upwards, so as to form a little piece which is easily seen at the shoulders, between the thorax and the elytra. The scutellum is longer than it is broad, and almost always triangular and pointed, whilst in both the Melolonthides and Rutelides it is as broad as it is long, and rounded behind. The Cetoniides proper are one of the most splendid groups of Coleopterous insects, and some of the tropical species vie in magnitude with the Dynastides. Indeed the *Goliathus giganteus*, of Lamark, from the west coast of Africa, is probably the largest Coleopterous insect known, being upwards of four inches in length, and two inches in breadth. The Cetoniæ do not raise their elytra in flying like other beetles, but spread their wings out laterally from beneath them, the elytra being a little hollowed behind the shoulders, to facilitate the operation. These are pre-eminently flower-beetles, and the mouth organs are furnished with a brush of hairs with which they collect the pollen. Many of the Cetoniæ differ in their habits from the majority of herbivorous Lamellicorns, by being actively diurnal, being often seen feeding upon pollen, and flying from flower to flower, in the heat of the day. We have in N. America eighteen species of Cetoniides proper, and twenty species belonging to the aberrant genera.

Our species of Cetoniides form six genera, which are very unlike in color and general appearance.

A. Side pieces of the mesothorax visible above; thorax somewhat triangular or trapezoidal, and nearly as wide at base as the elytra. *Cetoniides* proper.
B. Thorax with a lobe behind representing and covering the scutellum................GYMNETIS, 2
B B. Scutellum distinct..EURYOMIA, 14
A A. Side pieces scarcely or not visible above; thorax roundish or square, and decidedly narrower than the elytra.
C. Body almost naked; color black.
D. Thorax square, with prominent angles. Clypeus turned up in front. Size medium: CREMASTOCHILUS, 13
D D. Thorax roundish, with obtuse angles. Clypeus plane. Size very large: OSMODERMA, 3
C C. Body densely clothed with hairs or scales; colors various.
E. Hind coxæ contiguous. Body hairy; colors variegated......................TRICHIUS, 5
E E. Hind coxæ wide apart. Body covered with minute scales; ground color dark brown: VALGUS, 3

The *Gymnetis nitida*, Linn., (Fig. 41) is a beautiful velvetty-green beetle, three-quarters of an inch long, the bodies margined all around with orange-yellow, found throughout the Eastern States. Its larva has been found by Mr. Riley feeding on strawberry roots, and when out of the ground crawls with ease on its back. The *Euryomia fulgida*, Fab., is a glossy green species, two-thirds of an inch long; the elytra tinted with pale bronze, and with an irregular number of minute white points, and four large white spots on the tip of the abdomen. It is found on flowering shrubs, and is not uncommon at the west. The *Eur. Inda*, Linn., is our most common species of Cetonia. It varies in length from half to two-thirds of an inch; it is of a yellowish-brown color, the elytra sprinkled all over with small irregular black spots. It is sometimes troublesome by burrowing into ripe fruit, and also by feeding upon sweet corn in the milk. The larvæ, probably, like those of other known species, live in rotten wood, as the perfect insects are often seen flying over chip-yards, probably in search of a convenient nidus for their eggs. The *E. melancholica* is a much smaller species, almost black, with irregular transverse white lines on the elytra.

Cremastochilus, Knoch, contains a considerable number of rather rare species, half an inch or a little less in length, of a deep black color, sometimes with a few small white marks on the elytra. The mouth is peculiarly constructed. The clypeus or anterior margin of the head is thickened, and turned up, and the mentum is much enlarged, projecting forward so as to almost close the oral cavity, and its sides hang down like two curtains, which suggested the generic name, which means *hanging lip*. They have been found under stones beneath which were ants' nests; but their natural history is imperfectly known.

Osmoderma contains three American and one European species. The *O. eremicola*, Knoch, is upwards of an inch in length, black, with a faint chestnut tint, and with a smooth shining surface. The *O. scabra*, P. de B., is an inch long, black, the elytra being rough, with irregular, coarsely punctured striæ. *Trichius*, Fab., is composed of a number of closely allied species or varieties, the type of which is the *T. lunulatus*, Fab., a very common and pretty insect, often seen upon flowers in our gardens, basking in the hot sunshine, but readily taking to flight. It is a little less than four-tenths of an inch in length; the thorax dark brassy-green, the elytra more or less reddish on the disc, widely bordered with black, and with two transverse white marks on the side of each elytron. The under side is densely hairy.

Valgus contains three small brown species, densely covered with minute whitish scales. They are easily distinguished by their distant posterior coxæ, and their much shortened elytra.

Sixth Sub-section, SERRICORNES.

Antennæ serrate or saw-toothed. Food-habits various.

This sub-section of beetles with five-jointed feet is primarily distinguished, as its name implies, by the serrate or saw-toothed character of the antennæ. The serrate antenna is similar to the filiform in being slender, and usually of the same width throughout; but differs from it in having each joint project more or less inwards, that is, towards the antennæ of the opposite side, so as to give it a saw-toothed appearance; and this projection sometimes extends so far as to form what is called the pectinate or comb-toothed antenna; and when these processes are nearly as long as the antenna itself, they form what is called the *flabellate*, or branched antenna. But in many of the insects which are naturally classed in this sub-section this character of the antennæ is either wholly wanting, or so slightly developed that it can be scarcely distinguished from the filiform, and therefore it cannot be relied upon by the student without the aid of other characters. The only other insects of the pentamerous section, however, with which they could be confounded are the Filicornes proper of the first subsection, comprising the predaceous Ground-beetles, Cicindelidæ and Carabidæ, and the predaceous Water-beetles or Dytiscidæ. From the latter they are distinguished, not only by the want of any general resemblance, but more definitely by their legs not being fitted for swimming. And the ground beetles are distinguished by having apparently six palpi, and more conspicuously by their large egg-shaped posterior trochanters.

The Serricornes, as a whole, do not constitute a natural division, being composed of two very dissimilar tribes, viz: the saw horned wood-beetles, comprising the families Buprestidæ and Elateridæ, and the soft-winged carnivorous beetles, Lampyridæ, Telephoridæ, etc.; and in addition to these a number of small groups (Ptinidæ, Lymexylonidæ, Rhipiceridæ and Cupesidæ,) which do not strictly belong to either of the leading tribes, but which are usually classed with one or the other to avoid the creation of a great number of primary groups.* In accordance with our plan of classifying insects, as nearly as possible, according to their habits and the nature of their food, and at the same time leaving the two large and natural tribes just referred to undisturbed by discordant elements, we have adopted the expedient of throwing together a number of these small and heterogeneous families, under the title of *Aberrant Wood-beetles.* Thus arranged the Serricorn Coleoptera will form three tribes, which may be designated as follows:

1st Tribe. *Saw-horned wood-beetles.* STERNOXI, Latreille. Head inserted in the thorax as far as the eyes. Antennæ serrate or filiform. Pro-sternum advanced in front, and also prolonged behind into a point which is received into a cavity of the meso-sternum. Body elongate, or elliptical, moderately convex, and of a very hard consistency. Legs short and retractile. Anterior and middle coxæ small and globulus. Families: Buprestidæ, Elateridæ and Cebrionidæ.

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* "The creation of new families is a measure which should not be resorted to except at the last extremity."—LACORDAIRE, Genera des Col., IV, 258.

2d Tribe. *Aberrant wood-beetles.* XYLOTROGI partly, Latreille. Body short, with the head bent under the thorax, or elongate, with the head free. Antennæ various. Families: Ptinidæ, Lymexylonidæ, Rhipiceridæ and Cupesidæ.

3d Tribe. *Soft-winged predaceous beetles.* MALACODERMI, Latreille. Head free, but often partly or wholly covered by the thin anterior margin of the thorax. Antennæ serrate or filiform. Body more or less elongated, and depressed, soft, and with flexible elytra. Anterior coxæ conical and prominent, with large trochantins.* Families: Lampyridæ, Telephoridæ, Melyridæ, Cleridæ, Dascyllidæ.

TRIBE IX.

SAW-HORNED WOOD-BEETLES.

Lignivora serricornia. STERNOXI, Latreille.

The term *Sternoxi*, meaning *sharp-breasted*, given to these insects by Latreille, refers to their most distinctive character, namely, the extension of the pro-sternum or front breast-plate, backwards in the form of a sharp point, which is received into a corresponding notch or cavity in the meso-sternum. The sternum is also much advanced in front, and the fore legs are set remarkably far back from its anterior edge. The anterior coxæ or hip-pieces are almost globular, but not prominent. The antennæ are rather short, sometimes distinctly serrate, and sometimes simply filiform. The legs are short and capable of being contracted closely upon the body. They are of an oblong form, and usually of a very hard consistency. The larvæ will be described under their respective families. They are vegetable feeders, and are generally found in wood in a state of partial decay. The two first families are numerous in species, but the Cebrionidæ are few and rare, and no species has been found in the Northern States.

They comprise the three following families:

A. Body very firm; prosternal point elongated; abdomen with five segments.
  B. Prosternal point immovable; antennæ finely serrate; anterior and middle legs with trochantins; colors metallic .... BUPRESTIDÆ.
  B B. Prosternal point movable; antennæ often filiform; legs without trochantins; colors generally brown or black, and with the surface usually finely pubescent .... ELATERIDÆ.
A A. Body moderately firm; prosternal point short; abdomen with six segments: CEBRIONIDÆ.

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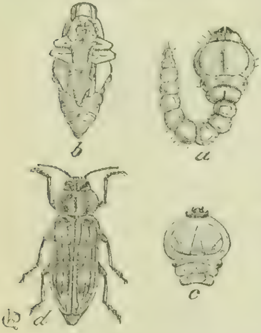
* The trochantin is an additional or supernumerary joint between the coxæ and the thigh, giving the latter the appearance of being composed of two pieces.

Family XXXIV. BUPRESTIDÆ.

The name Buprestis was given by the ancients to some kind of noxious insects which cannot now be determined; but it was subsequently given by Linnæus to the insects of the present family. They might properly be called, in English, *metallic beetles*, in reference to their very hard and inflexible bodies, and their metallic coloring. They are further distinguished by their short, slender and finely but distinctly serrate antennæ, and the presence of trochantins in the anterior and middle legs. They are usually of an oblong elliptical form, and somewhat depressed or flattened, but some of the smaller species are either elongate, slender, and almost cylindrical, or short and ovate. The scutellum is very small and sometimes wanting. The Buprestidæ are pre-eminently a tropical family, and in those torrid regions they attain a large size, and reflect the light from their polished bodies with an almost dazzling brilliancy.

[Fig 42.]



CHRYSOBOTHRIS FEMORATA, Fab:.—Flat-headed borer of the apple tree, and of the soft maple: *a*, larva, *c*. head of larva, underside; *b*, pupa; *d*, beetle—after Riley.

The larvæ present two very distinct forms. The usual form is at once distinguished from all other Coleopterous larvæ by the enormous development of the first segment of the body, into which the head is partly retractile. The other segments are narrow and slightly flattened. This form of the larvæ has caused them to be compared with tadpoles, and the French authors describe them as resembling a pestle. They are wholly destitute of legs.

These larvæ usually reside under the bark of trees in a state of incipient decay, but some of them penetrate into the solid wood. Some of the smaller species inhabit the stems of small trees or shrubs, causing them to enlarge so as to resemble galls. An example of the former is the flat-headed borer of the apple and soft maple trees; and an example of the latter is the raspberry cane borer, or larvæ of the *Agrilus ruficollis.*

The other form of Buprestide larva is that of the Brachyides or short-bodied Buprestidæ. In these the first segment is not enlarged, the body is slender and tapering, and each of the three first segments is furnished with a pair of very small feet, placed wide apart. These species are all very small, and such of them as are known are leaf-miners. In an economical point of view, the Buprestidæ occupy a peculiar position, intermediate between the genuine wood-borers (Cerambycidæ and Scolytidæ), which bore into the solid wood of trees, and those kind of wood-beetles which (like the Elateridæ and many of the Heteromerous beetles) inhabit wood and bark in an advanced state of decay. In accordance with this position, they are usually the first insects to attack trees which have been injured by sun-scald, or which have otherwise had their vitality weakened.

The following are the genera of Buprestidæ:

A. Hind coxal plates* much widened at their inner extremities. Body oblong and somewhat depressed, and more or less elliptical or narrowed at the two extremities. Size usually large or medium. (*Buprestides* proper.)

B. The epimera (or hinder side pieces) of the metasternum triangular and exposed; prosternum acutely angulated behind.

C. Mesosternum and metasternum united without suture. First joint of the hind tarsi as long as the second and third united. Size large or very large..................CHALCOPHORA, 7 sp.

C C. Mesosternal suture distinct; size rather large or medium.

D. Elytra tapering to a point and slightly separated at their tips; 1st joint of hind tarsi scarcely longer than 2d..DICERCA, 21 sp.

D D. Elytra moderately narrowed behind. 1st tarsal joint elongated..........BUPRESTIS, 23 sp.

B B. Epimera of the metasternum partly covered by an anterior prolongation of the margin of the abdomen. Prosternum acutely angulated behind.

E. Front with a pit or depression for the insertion of the antennæ. Size moderate: CHRYSOBOTHRIS, 43 sp.

E. Front without pit. Size small.

F. Thorax waving at its junction with the elytra........................MELANOPHILA, 10 sp.

F F. Thorax cut straight across behind ....ANTHAXIA, 14.

A A. Hind coxal plates but little widened at their inner extremities. Size never above medium; usually small or very small.

G. Front without pits for the insertion of the antennæ. Thorax straight behind. Scutellum none. Body clothed with short erect hairs. Colors often variegated: ACMÆODERA, 23 sp.

G G. Front pitted for antennæ. Thorax angulated behind. Scutellum distinct. Body not hairy.

H. Body elongated, narrow, almost cylindrical. Prosternum without grooves for the reception of the antennæ..AGRILUS, 40 sp.

H H. Body short and broad. Prosternum with grooves for the antennæ. Tarsi very short.

I. Body ovate; scutellum small; tibiæ slender..........................BRACHYS, 8 sp.

I I. Body sub-triangular; scutel large; tibiæ dilated.................METONIUS, 2 sp.

The largest N. A. species of Buprestis is the *Chalcophora virginiensis* of Drury, nearly or quite an inch in length, of a dark coppery or blackish color, and a very uneven surface, caused by elevated lines and depressed square-shaped spots. The larva inhabits the trunks of different kinds of pine trees, and the perfect insects are to be found, therefore, only in pine growing regions. The *Dicerca divaricata*, Say, is three-quarters of an inch or more in length, copper colored, with a granulated surface. It is distinguished at once by its tapering elytra, separated at the tips. Its larva bores into the trunks of cherry and peach trees. We have another, smaller and more obscure species, the *D. lurida*, Fab., the larva of which inhabits the hickory. The *Chrysobothris femorata*, (Fig. 42) an obscure bronze-black species, rather less than half an inch in length, is the parent of the well known *flat-headed borer*, so injurious to apple trees, and also to the soft maple.

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* The hind coxal plates are the flat and narrow transverse pieces which border the under side of the thorax behind, and are separated by a suture from the metasternum. They are marked C X P in Fig. 3.

The genus *Acmæodera*, Esch., contains a number of small species of a bronzed-brown color, sometimes with purple and green reflections, and the elytra prettily spotted with yellow. The colors are somewhat obscured by the surface being clothed with stiff erect hairs. The *A. tubulus*, Fab., and the *A. pulchella*, Herbst, are the most common species. They are often found in abundance on the flowers of the Coreopsis.

The genus *Agrilus*, Solier, is easily recognized by the elongate, slender, and cylindrical form of the species. The raspberry borer, *Agrilus ruficolis*, Fab., may be taken as the American type of this genus. It is three-tenths of an inch long, black, with a coppery-red thorax.

Buprestis, including *Anchylochira*, Esch., is composed of species mostly between a half and three-quarters of an inch in length, of a brassy-green or a brassy-black color, and often ornamented with yellow spots on the elytra; some also have yellow spots on the sides of the venter.

The species of *Melanophila*, Esch., are from three to five-tenths of an inch in length, black, sometimes with obscure bronze or purple tints. Some species have four yellow dots on each elytron.

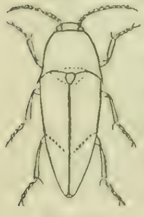
The species of *Anthaxia*, Esch., are less than three-tenths of an inch long, brassy-black, and without spots. The head and thorax are sculptured with shallow punctures, with the intervening lines forming a fine net-work.

We have two common species of *Brachys*, Sol., the *ovata*, Weber, and the *ærosa*, Melsh., *(terminans?* Fab.*)*; and several rarer species, some of which may be only varieties or races of the first. The *B. ovata* is two-tenths of an inch or more in length, of a bronze color, variegated with spots and imperfect transverse waving bands of whitish and copper colored pubesence. The *B. terminans* is smaller and less distinctly variegated, but most readily distinguished by the pale tips of the elytra. *Metonius*, Say, (*Pachyscelus*, Solier,) has two species, about an eighth of an inch in length; the *lævigatus*, Say, wholly black; and the *purpurea*, Say, black, with dark-blue elytra.

Family XXXV. ELATERIDÆ.

The term *elater* applied to these insects by Linnæus, and the name *skip-jacks*, sometimes given to them by English authors, have reference to their most striking peculiarity, that of having the faculty, when placed on their backs, of righting themselves by a spasmodic jerk, by which they are thrown several inches from the surface upon which they are placed. In this operation the sharp point which projects backwards from the pro-sternum is thrown violently into the corresponding socket in the meso-sternum.

[Fig. 41.



ELATER.

They are distinguished from the allied Buprestidæ, not only by this saltatory power, but also by the posterior angles of the thorax being prolonged backwards to a point, so as to embrace the base of the elytra, and by the bases of the thorax and of the elytra sloping downwards towards each other, which, in addition to a slight separation between them, permits the freedom of motion which these parts have upon each other. The thighs moreover are almost or entirely destitute of the accessory joint at their base called the trochantin. The elaters are also readily distinguished by their usually dull brown colors, very rarely changing to black or red, and by their surface being almost always clothed with a fine pubescence.

[Fig. 44.]

LARVA OF ELATER.

The larvæ are elongate, slender, of the same width throughout and of a hard and almost horny consistency, and furnished with short legs. The last segment is sometimes forked at the extremity, sometimes 3-toothed, and sometimes entire. They bear a strong resemblance to the meal-worms or larvæ of Tenebrio, but differ in the structure of their mouths.

These larvæ go by the common name of wire-worms. With respect to their food they may be divided into two classes: those which live in rotten wood, being frequently found under the bark of decayed stumps and prostrate logs, and sometimes, but rarely, penetrating into solid wood*; and those which feed upon the roots of grasses and of other plants. The natural food of the larvæ of the latter division appears to be the roots of grasses, both wild and cultivated, but from these they spread to the roots of almost all kinds of cultivated plants, including Indian corn and the small grains, and various kinds of garden vegetables. In some localities they rank amongst injurious insects of a very serious character.

The Elateridæ constitute one of the most extensive, and one of the most natural families of Coleoptera, but their division into minor groups is very difficult, on account of the great numbers and the strong general resemblance of the species. In treating upon this subject, Lacordaire makes the following remark: "The classification of this family presents extreme, and perhaps insurmountable difficulties. If we examine the works of the most recent authors, Germar and Erichson, we shall see that both of them despair of the classification of these insects. The latter, indeed, has expressed the wish that some new characters may yet

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*Mr. C. V. Riley has shown me a specimen of *Hemirhipis facicularis*, Fab., distinguished for its beautifully pectinated antennæ, which was reared by him from a larva which he found boring through the heart wood of the Pecan Hickory, thus proving that some of the Elateridæ are genuine wood-borers and corroborating the propriety of placing them in the same tribe with the wood-boring Buprestidæ. [Since the above was written, Mr. Riley informs me that he strongly suspects that the Hemirhipis larva was preying on that of Clytus pictus which was boring the same tree, and not feeding on the wood itself.]

be found which will enable us to establish it upon rational bases; but many months' assiduous labor compels me to declare that such characters do not exist, and that we shall search for them in vain. We must trust therefore to tradition to supply the inadequacy of science."

They comprise two well marked but very unequal sub-families, as follows:

First Sub-family, *Eucnemides.* Antennæ inserted upon the front. Head bent down upon the breast in repose.

Second Sub-family, *Elaterides.* Antennæ inserted under the margin of the front. Head directed forwards.

Sub-family EUCNEMIDES.

This sub-family is composed of a moderate number of small, comparatively rare, black or brown insects, and more or less clothed with minute yellow hairs. They resemble the Elaterides in their elongated slender forms, but are distinguished by their vertical heads, the mouth being inferior, and not anterior as in the Elaters. The antennæ also, as a general rule, are more strongly serrate, and in the males often pectinate or even flabellate. The palpi are often terminated by a widened or hatchet-shaped joint. Whilst the perfect insects strongly resemble the Elaterides, such of their larvæ as are known have a striking resemblance to those of the preceding family of Buprestidæ, both in form and habits, being abruptly enlarged at their anterior extremity, and being found in wood in an incipient state of decay.

The following tables exhibit those genera which are most common or most numerous in species:

A. Antennæ inserted in pits on the front, at some distance apart; claws not serrate.
B. Maxillary palpi with the last joint acute.................................Melasis, 4 sp.
B B. Maxillary palpi with the last joint dilated.
C. Grooves for the antennæ under the margin of the thorax.
D. Antennæ serrate.................................Eucnemis, 3.
D D. Antennæ filiform.................................Fornax, 14.
C C. Antennal grooves wanting.................................Nematodes, 3.
A A. Antennæ inserted close together on the front; claws serrate.................................Cerophytum, 2.

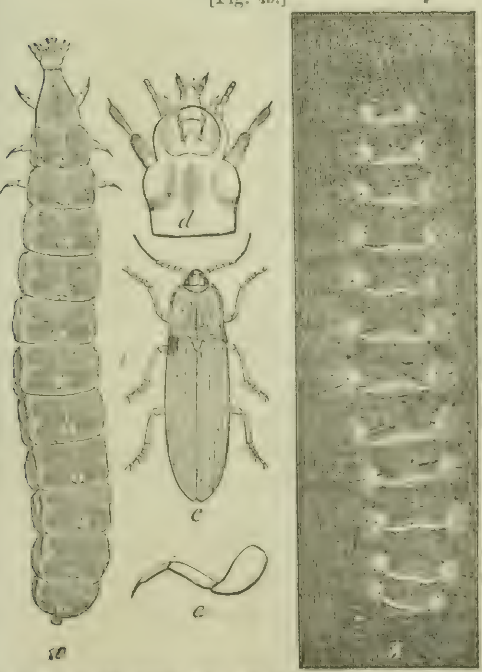
Sub-family ELATERIDES.

A. Sternum with deep grooves for the reception of the antennæ.................................Adelocera, 16 sp.
AA. Sternal grooves obsolete or wanting.
B. Mesosternum connate with the metasternum; very large species clothed with whitish scales, and with two eye-like spots on the thorax.................................Alaus, 4.
B B. Mesosternal suture distinct, and without the other above mentioned characters.
C. Hind coxal plates suddenly dilated inwards, and prolonged into a tooth at the posterior angle; claws never pectinate.
D. Prosternal spine truncate; scutellum heart shaped.................................Cardiophorus, 32.
D D. Pro-sternal spine acute; scutellum oval.
E. Anterior margin of the front not elevated; coxal plates moderately dilated; large species with distinctly serrate antennæ.................................Ludius, 5.

E E. Anterior margin of the front slightly elevated, forming a transverse ridge which separates the front from the upper lip. Size sometimes large, but usually medium or small.
  F. Prosternal sutures single and convex on the outer side; tarsi slender; size small: CRYPTOHYPNUS, 31.
  F F. Prosternal sutures double and straight, or concave on the outward side.
    G. Tarsi simple..ELATER, 51.
    G G. Fourth tarsal joint bilobed..............................MONOCREPIDIUS, 15.
    G G G. Second and third joints lobed..........................DICREPIDIUS, 8.
C C. Hind coxal plates gradually and but slightly dilated inwardly and often without a sharp posterior angle; claws sometimes pectinate.
  H. Front convex; mouth inferior..................................AGRIOTES, 12.
  H H. Front flattened, and with an elevated margin; mouth anterior.
    I. Claws pectinate..MELANOTUS, 47.
    I I. Claws simple.
      K. Eyes prominent; 1st joint of hind tarsi as long as the 2d and 3d united: ATHOUS, 25.
      K K. Eyes small; 1st joint of hind tarsi less elongated...............LIMONIUS, 39.
  H H H. Front flattened, without elevated margin; mouth anterior.
    L. Size large; color shining black..............................MELANACTES, 8.
    L L. Size moderate; colors various..............................CORYMBETES, 93.

The Elaterides proper constitute an extensive series of comparatively homogeneous insects, the great majority of which are of a uniformly brown color, and varying in length between one-quarter and three-quarters of an inch; though there are a few large or very large species. The determination of the genera and species of this family requires, therefore, an amount of study and an aptness for observations of this kind, which can scarcely be expected from any but professed entomologists. We will only refer to a few species which are remarkable for their size, or for their exceptionally varied coloring.

[Fig. 45.]



MELANACTES PICEUS, DeG.—*a*, supposed larva, as seen by day; *b*, same as seen by night; *c*, beetle; *d*, enlarged head and parts; *e*, enlarged leg of same—after Riley.

Our largest and most striking species is the well known *Elater (Alaus) occulatus*, of Linnæus. It is usually nearly an inch and a-half in length, though individuals are not unfrequently seen which scarcely exceed an inch. Its gray color is produced by a dense sprinkling of small whitish spots and lines upon a black ground. These spots are composed of minute whitish scale-like hairs. But its most conspicuous character is the two large eye-like spots on the top of the thorax, which are expressed by the specific name. The larva inhabits partially decayed wood, and is often found in the trunks of old apple trees. The *Elater rubricollis*, Say, is a little more than half an inch long, black, with a light-red thorax, bordered and pointed behind with black. The *Elater sanguinipennis*, Say, is black, with light-red elytra; three-tenths of an inch in length. The *E. apicatus*, Say, is similar, but larger, being nearly half an inch in length, and the elytra are tipt with black. The *E. nigricollis*, Say, varies from less than half to three-quarters of an inch in length; black, with whitish elytra. The *E. linteus*, Say, resembles the last, but is distinguished by having the suture and tip of the elytra black. *E. scapularis*, Say, is a little less than four-tenths of an inch long, greenish-black, with the base of the elytra and the hind points of the thorax, clay-yellow. The tarsal joints are lobed beneath. It is now included in the genus *Athous*. The *Limonius armus*, Say, is also light-red on the shoulders of the elytra, but the thorax is wholly black, the tarsi are simple, and the length is only a quarter of an inch. Several species of *Corymbetes* have the elytra brownish-yellow with transverse zig-zag black bands. *C. hieroglyphicus*, Say, half an inch long, has two bands; and *C. hamatus*, rather smaller, has but one band near the tip.

The *Melanotus fissilis*, Say, *(cinereus*, Weber ?*)* and the *M. communis*, Sch., plain brown species, usually about half an inch in length, but subject to considerable variation in size, are amongst our most common beetles. The two species closely resemble each other, but the latter is a little smaller, and the thorax is proportionally longer and less convex. They are distinguished from other and somewhat similar Elaters by their pectinate claws. They are sometimes found under the bark of dead trees, having probably recently emerged from the pupa state. But they are also found upon the leaves of trees, to which their pectinate claws enable them to adhere. We have repeatedly seen them at rest in the enclosure formed by the tying together of the leaves of the black walnut, by the larvæ of the little moth, *Phycita juglandis*, LeB.; but for what purpose was not apparent.

The *Melanactes piceus*, DeG., (Fig. 45) is a large glossy black species, an inch or more in length. It is not uncommon in the latitude of southern Illinois, where it is sometimes jarred from peach trees upon the curculio-catcher. Mr. Riley has found and figured its supposed larva, which is one of the most beautiful objects, and often attracts the attention of the curious in the southern part of the State, by its luminosity; the animal glowing in the dark with a beautiful green light as represented in the figure.

TRIBE X.

ABERRANT WOOD-BEETLES.

Lignivora aberrantia.

Under the title of aberrant or exceptional Wood-beetles, as stated in the general remarks upon the Serricornes, we have included, for the sake of brevity and convenience, a number of small families, some of which have but a remote relationship to the others, but which cannot naturally be united with any of the larger tribes.

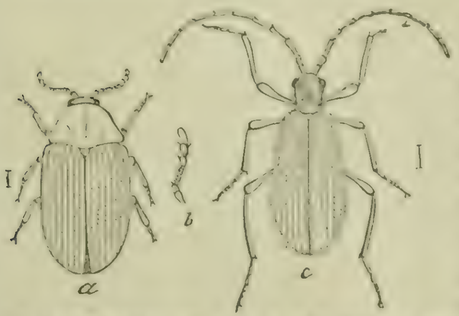
This tribe contains two very dissimilar groups. In the first, which is composed of the family of Ptinidæ, including the sub-family of Bostrichides, the body is rather short and thick, or moderately elongated and cylindrical, and the head is bent down and mostly or wholly concealed under the vaulted or hood-like thorax.

In the other group, which includes the small families of Lymexylonidæ, Cupesidæ and Lyctidæ, the body is much elongated and often depressed, and the head is free and exposed, and sometimes attached to the thorax by a short neck. These three families combined do not contain more than a dozen known American species, most of which are rare, and are found mostly under the bark of decaying trees. Many authors include them in some one or other of the larger families.

Family XXXVI. PTINIDÆ.

This is a family of moderate extent, composed of small insects, rarely exceeding a quarter of an inch in length, and often only about half that length, and usually of a cinnamon-brown color, sometimes black and sometimes ornamented with patches of whitish scales. Their most distinctive character is the vaulted or hood-like form of the anterior part of the thorax, the head being bent under it or partly retracted within it, so that it can be scarcely or not at all seen when the insect is viewed from above. The antennæ are generally filiform, but in *Bostrichus* they terminate in three larger joints. The tarsi are simple. The larvæ resemble those of the Lamellicorn beetles, in miniature, being soft and white, and usually lying in a curved or semi-circular position. They have six legs, but do not use them in crawling in the usual way, but draw themselves along upon their sides.

[Fig. 46.]



a, ANOBIUM PANICEUM, Fab.: *b*, its antennæ; *c*, PTINUS BRUNNEUS, Dufs.—after Riley.

The *Ptini* proper subsist upon substances in a state of incipient decay, and are often found in cellars and out-buildings. The *Anobii* are usually found in wood more or less decayed; but the *Bostrichi* bore into solid wood, and are often seriously injurious, more especially to forest trees. Indeed, the last mentioned insects bear so striking a resemblance, both in their short cylindrical forms and their eminently wood-boring habits, to the short-horned wood-borers *(Scolytidæ)*, in the tetramerous section, that one feels strongly tempted to place them in the latter tribe; but in the details of their organization they are more closely allied to the more highly organized Ptinidæ, especially in the more fully developed antennal club, labrum, and maxillary palpi. The larvæ also have six feet, whilst those of the Scolytidæ are footless.

The following are the principal genera:

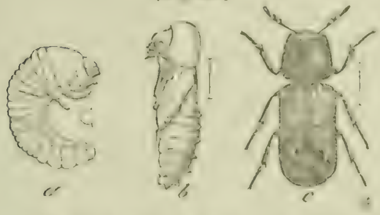
A. Antennæ filiform, sometimes branched. Tibial spurs very small or wanting; tarsi distinctly 5-jointed.
  B. Head and thorax much narrower than the elytra; antennæ filiform and simple and inserted upon the front, and about as long as the body.......................................PTINUS, 8 sp.
  BB. Form cylindrical or sub-globular. Antennæ usually either branched or with the three last joints longer than the others, and inserted before the eyes.
    C. Antennæ simple, but with the three terminal joints elongated.......................ANOBIUM, 22.
    C C. Antennæ branched in the male, serrate in the female...........................PTILINUS, 3.
A A. Antennæ terminating in three larger and somewhat serrate joints; tibial spurs distinct; tarsi apparently 4-jointed. Thorax asperous. Elytra often truncated and toothed behind:
BOSTRICHUS, 19.

The *Ptinus fur*, Linn., is three-twentieths of an inch long, light brown, with two whitish bands across the elytra, interrupted in the middle. The thorax is uneven, having a tubercle on each side and two on the back. This insect feeds upon almost all kinds of dried animal matter, and is often very injurious in museums of natural history. It was originally a native of Europe, but has become disseminated over the civilized world. We have a very similar species in this country, the *humeralis*, of Say, which is regarded by some as only a variety of the European species. We have also another common species, often found in company with the others, in cellars and out-buildings. This is the *Ptinus brunneus*, and is distinguished at once from the others by being wholly of a light-brown color, and destitute of the bands on the elytra.

Our most common species of Anobium is the *A. tenuestriatum*, Say, scarcely three-twentieths of an inch in length, of a uniform, cinnamon-brown color, with a microscopically fine silken pubescence, and the elytra with fine impressed lines or striæ. This species is also injurious to cabinets and herbaria. It may often be caught upon the wing in or about our houses.

The genus Bostrichus contains a number of small species, which, in their larva state, are genuine wood-borers, and some of which are seriously injurious both to fruit and forest trees. The *B. bicaudatus*, a

[Fig. 47.]



Bostrichus (Sinoxylon) Basillare, Say.: *a*, larva; *b*, pupa; *c*, beetle—after Riley.

plain, grayish-brown species, three-tenths of an inch, or a little more, in length, with one tooth at the end of each wing-cover, is very common at the West, where it sometimes excites serious apprehensions in the spring, by boring into the twigs of apple trees; but their injury is of a transient character. The *B. basilaris* (Fig 47) is two-tenths of an inch in length, black, with reddish antennæ, and each elytron with a large red spot on the base, and three teeth at the end. The larva of this species is usually found in the shag-bark hickory, which it sometimes destroys, by riddling the solid trunk with innumerable holes. It also sometimes infests fruit trees, and has been found in the grape vine.

Family XXXVII. LYMEXYLONIDÆ.

A small family of anomalous insects, founded upon the genus *Lymexylon*, Fab., a term derived from the Greek *lume*—a *destroyer*, and *xulon*—*wood*. They are elongated narrow beetles, with free heads, and short serrate antennæ; the elytra sometimes remarkably shortened, and with the maxillary palpi often furnished with long branching appendages. We have but few N. A. species, all of which are rare. The *Lymexylon navale* is notorious for the extensive destruction sometimes produced by its larvæ to the ship timber floating in the docks in the northern part of Europe. At the suggestion of Linnæus the timber was sunk under water at the time of the year when the females deposit their eggs, and was thus preserved from their attacks.

Family XXXVIII. CUPESIDÆ.

This is another small anomalous family, containing but four known species, two of which inhabit N. America, one is found in Chili, and the other in the Phillipine Islands. The form is elongate, the elytra are strong, sculptured with longitudinal ribs and square depressions between them. The antennæ are filiform, and the head is tuberculate behind, and attached to the thorax by a distinct neck. The *Cupes cinerea*, of Say, is widely distributed but of rare occurrence. Mr. Say, however, speaks of it as being sometimes found in considerable numbers about old frame buildings.

TRIBE XI.

SOFT-WINGED PREDACEOUS BEETLES.

Carnivora mollipennata. MALACODERMI, Latreille.

The insects of this tribe are distinguished from most other Coleoptera, and from all others in the pentamerous section, by their soft bodies and their thin and flexible elytra. The antennæ are usually more or less serrate; the palpi terminate in a widened triangular or hatchet-shaped joint; the thorax is usually surrounded with a thin projecting margin; and the fourth-joint of the tarsi is more or less bi-lobed. The term *Malacodermi*, meaning soft-skinned, given to these insects by Latreille, expresses their most remarkable character, and is in general scientific use.

They are exclusively carnivorous in their diet, both in the perfect and the larva state, feeding upon small worms, larvæ and snails, and are therefore one of the agencies for checking the excessive multiplication of other insects.

The larvæ are elongated, flattened, usually a little tapering toward each end, of a tough or leathery texture, and of a brown or black color, and often clothed with short hairs. They are furnished with slender, sharp and projecting mandibles, with which they sieze their prey. They are sometimes found on trees, but usually on the ground or under the bark of dead trees, in search for small wood-eating larvæ. A few are found in ants' nests.

This tribe comprises the three following families:

A. Body and wing cases flexible; thorax almost level, with a thin margin all around. Antennæ not enlarged at the tip.
  B. Antennæ inserted upon the front or upon the base of the rostrum; front without membraneous suture; 4th joint of tarsi more or less bi-lobed; palpi clavate.......................................LAMPYRIDÆ.
  B B. Antennæ inserted laterally before the eyes; epistoma separated from the front by a membraneous suture; tarsi entire; palpi usually filiform. MELYRIDÆ.
A A. Body rather firm; thorax convex, without a sharp margin or with a very narrow one, low down upon the side; antennæ generally widened at the tip; palpi clavate.. ....CLERIDÆ.

Family XXXIX. LAMPYRIDÆ.

This family contains the well-known fire-flies, or lightning-beetles, and the family name, from a Greek word meaning *to shine*, was intended to express this quality. This property is possessed both by the larvæ and the perfect insects, but only a small number of species are endowed with it. Their principal characters have been given in the foregoing table and in the general description of the tribe. They are usually medium sized, sometimes small, but rarely very small. They are mostly plain insects without brilliant colors; usually black or brown, and many have the thorax margined with red or yellow.

The Lampyridæ comprise three sub-families, which may be characterized as follows:

A. Elytra reticulated; middle coxæ separate; head partially covered by the anterior margin of the thorax..LYCIDES.
A A. Elytra not reticulated; middle coxæ contiguous.
  B. Head nearly or quite covered by the thorax; antennæ usually approximate; side pieces of metasternum rather wide ....LAMPYRIDES.
  B B. Head wholly uncovered by the thorax; antennæ rather distant; side pieces of metasternum tapering to a point behind .............TELEPHORIDES.

Sub-family LYCIDES.

The Lycides are distinguished by their reticulated elytra, produced by elevated lines and cross-lines. The genus Lycus, and some others, have the head more or less prolonged in front in the form of a snout.

A. Head with a distinct beak; antennæ inserted in front of the eyes; elytra usually widened behind: LYCUS, 3 sp.
A A. Head without distinct beak; antennæ inserted between the eyes.
  B. Elytra widened behind; thorax carinate ....CALOPTERON, 7.
  B B. Elytra parallel; thorax not carinate ....EROS, 16.

Lycus, Fab., including *Dictyopterus*, Latr., which differs only in having the rostrum shorter and more robust, contains three known North American species.

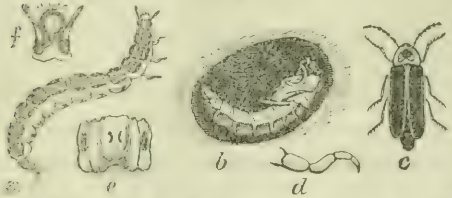
Calopteron, Guerin, contains a number of species, two of which at least are rather common and conspicuous insects: the *C. reticulatum*, Fab., five or six-tenths of an inch in length, yellow, with the middle of the thorax, a broad band across the elytra, and a broad tip of the same, black; and the *C. terminale*, Say, of the same size and color, but without the middle band on the elytra. A much smaller species, the *C. dimidiatum*, Fab., (*scapulare*, Newman,) is blackish, with the margin of the thorax, and the tips of the shoulders, yellow. The antennæ are strongly pectinate, or branched. It is the type of the genus *Cænia*, of Newman.

Eros, Newman, contains many species, the most conspicuous of which is the *E. coccinatus*, Say, four-tenths of an inch long, and of a bright scarlet color.

Sub-family LAMPYRIDES.

The remarks made above upon the present tribe of soft-winged Carnivora, and upon the family of Lampyridæ, apply especially to the sub-family of Lampyrides proper, and need not be here repeated. Their

[Fig. 48.]



PHOTINUS PYRALIS, Linn.:—Common fire-fly; or, more properly, Lightning-beetle; *a*, larva; *f*, *e*, *d*, head, under side of segment, and leg of same; *b*, pupa in its earthen cell; *c*, beetle—after Riley.

most distinctive character is the extension of the thin thoracic margin, which is narrow in the other sub-families, but is here expanded so as, in most cases, to completely cover the head. It is in this sub-family that we find the species remarkable for their luminous or phosphorescent property, which is possessed by no other insects except a few of the Elateridæ.* This property is located in one or more of the segments on the under side of the abdomen. The luminous power is intermittent, being exhibited by flashes, and is evidently controlled by the will of the insect. It is a vital phenomenon, and consequently ceases after death; but the luminous segments can be distinguished in the dried specimen by their uniformly yellow color.

The historic and poetic *glow-worm* is the wingless female of the European *Lampyris noctiluca*, Linn. But in most of our species both sexes are furnished with wings.

The Lampyrides are nocturnal insects, being sluggish by day, and found sometimes on the ground, and sometimes resting upon the foliage of trees, or upon the palings of fences. But at night they launch out upon the wing, sometimes in immense numbers, especially in low meadows, which they illuminate with their multitudinous flashes of phosphoresence.

The following are the principal genera:

A. Elytra complete, except in some wingless females; head wholly or partially covered by the thorax.
  B. One or more ventral segments, pale yellow, and luminous in the living insect.
    C. Antennæ dilated and compressed; the abdominal segments of the males lobed at the sides; the last segment only luminous...LUCIDOTA, 3 sp.
    C C. Antennæ slender; the abdominal segments simple; one to three last segments luminous: PHOTINUS, 26.
A A. Elytra much abbreviated and attenuated; head exposed; antennæ branched: phosphorescence uncertain...PHENGODES, 2.

The *Lucidota atra*, Fab., supposed to be the same as the *laticornis* of the same author, is a common insect. It varies from three to four-tenths of an inch in length, and is of a deep black color, with the margin of the thorax pale yellow. The genus *Photinus*, Laporte, contains most of our lightning beetles. The *P. pyralis*, Linn., (Fig. 48,) is half an inch or a little more in length, blackish, thorax with yellow margin and red disk, with a blackish spot in the center; the elytra have a narrow yellowish border, and suture. Mr. Riley has shown that it is luminous in the larva and pupa as well as the perfect state. It is common in the latitude of Southern Illinois; but farther north and east its place is to a great extent supplied by a very similar but much smaller species, the *P. scintillans*, Say. The *P. angulata*, Say, is as large as the *pyralis*, and is distinguished by its generally paler color, the wider yellow margin of the elytra, and by the extreme margin of the thorax being clouded with black. Certain species which (like the *P. pensylvanica*, of DeGeer), have the head but partially covered by the thorax, were placed in a separate group by Dejean, to which the name Photuris was subsequently given by LeConte. The genus is retained by Lacordaire, but it is abandoned by Dr. LeConte himself, in his work on the Classification of the Coleoptera.

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* We should perhaps also except the *Fulgora lanternaria* of S. America, and the *F. candelaria*, and the *Buprestis ocellata* of China, and a few other insects which have been reported to possess luminous properties. But the testimony with regard to all of them is very conflicting, even with respect to the first mentioned, the luminousness of which has been generally believed.

The *Lampyris plumosa*, of Olivier, is the type of the remarkable genus *Phengodes*, Hoff. The antennæ are beautifully plumose, and the elytra are abruptly narrowed to a point, and do not extend more than a third the length of the abdomen. It is half an inch long and of a brownish color. Six other species are known which inhabit South America. Lacordaire states that these insects possess luminous properties, but Leconte questions this, as none of the ventral segments exhibit the usual sulphur-yellow color in the dried specimens. In the specimens in my collection, the ventral segments are black in the middle, and fulvous or tawny yellow at the sides, with a narrowed portion at the base of each segment of a lighter yellow color, and this may possibly be the seat of the phosphoresence.

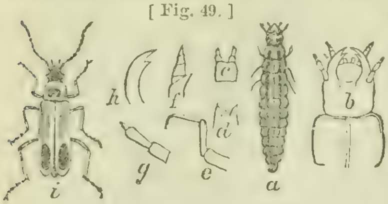
Sub-family TELEPHORIDES.

In this sub-family the head is usually wholly uncovered by the thorax, and narrowed behind into a short neck. They are more active than the other Lampyridæ, and are often found upon flowers, or running over the surface of leaves in search for their prey, which seems to consist mostly of the soft larvæ of other insects.

A. Head partially covered by the thorax; maxillæ elongated and extensile; elytra yellow with a large black spot or stripe .... CHAULIOGNATHUS, 9 sp.
A A. Head wholly uncovered; maxillæ normal; elytra black, sometimes with a narrow yellow border.
  B. Head with a distinct neck; size various........ TELEPHORUS, 72.
  B B. Head without visible neck; size small .... SILIS, 4.

The genus *Chauliognathus*, Hentz, is remarkable for the extensile maxillæ, apparently analogous to the elongated maxillæ and labium of bees, with which they lap the honey of flowers. Indeed, the perfect insects are usually found upon flowers, especially those of the golden rod, upon which they have been said to feed; in which case they form an exception to the carnivorous habits of the family in which they are placed. The beetles, however, are furnished with sharp curved mandibles like other Telephorides, and the larvæ are known to be pre-eminently carnivorous. We have two common species of the genus: the *C. pensylvanicus*, DeGeer, (Fig. 49,) with a large oval black spot near the end of each elytron; and the *C. marginatus*, Fab., with a broad black stripe through the middle of the elytron. *Telephorus*, Schæffer, contains many species, varying from less than a quarter to more than half of an inch in length. They are black, with the thorax usually partly or wholly reddish-yellow. *Silis*, Megerle, contains a few small species, less than a quarter of an inch in length, and colored like Telephorus, from which they differ in having the head inserted in the thorax, which is two or three times as wide as it is long, and with a notch on the side and near the posterior angle, usually most conspicuous in the males.

[Fig. 49.]



Chauliognathus pensylvanicus, DeGeer:—*a*, larva; *b*, head of larva magnified, showing antennæ, mandibles, and palpi. The small side figures show the same parts still more highly magnified: *i*, beetle—after Riley.

Family XL. MELYRIDÆ.

This is a family of small extent, and is composed mostly of small or very small species. They bear a general resemblance to the preceding family, but are usually smaller and differ in the palpi not being widened at the tip, and in the fourth joint of the tarsi not being bilobed, in both of which characters they differ from the great majority of the soft-winged beetles. The species of the genus Malachius have the singular power of protruding from the sides of their bodies a number of soft orange-colored vesicles, the use of which is a matter of conjecture. They are supposed to be instrumental in deterring their enemies. The larvæ are carnivorous, like those of the other Malacodermes; but the perfect insects are generally found upon flowers, and are supposed to feed upon their more tender parts.

The two leading genera in our fauna are Malachius—which has been divided into a number of sub-genera, all of which possess the extensile vesicles—and Dasytes, in which the vesicles are wanting.

Family XLI. CLERIDÆ.

In this family the labial palpi terminate in a large hatchet-shaped joint, and the fourth joint of the tarsi is bilobed; but the body is tolerably firm, and the antennæ depart from the common serrate character in being more or less widened towards the tip; but the enlargement differs from the genuine clavate, in being more or less flattened, and sometimes strongly serrate. They also differ from the Malacoderms proper in having usually but five segments in the abdomen, whereas the latter have seven. The Cleridæ are usually rather below the medium size, often prettily colored with orange and blue, and their surface is usually more or less pubescent or hairy. They are oblong in form, and the thorax is considerably narrower than the elytra.

These insects are purely carnivorous. The larvæ are sometimes found under the bark of dead trees, in company with the small wood-eating larvæ, upon which they subsist. Others are found in the nests of ants, and still others in the dried carcases of dead animals.

The genera of Cleridæ is as follows:

A. Tarsi 5-jointed; thorax rounded at the sides, without a sharp margin.
B. First tarsal joint of ordinary length; body much elongated.
C. Antennæ 10-jointed, the last very long and flat..........ELASMOCERUS, 1 sp.
C C. Antennæ 11-jointed; serrate but little enlarged at tip.
D. Eyes finely granulated..........TILLUS, 1.
D D. Eyes coarsely granulated..........CYMATODERA, 17.
B B. First tarsal joint usually small and concealed beneath the second; body moderately elongated.
E. Eyes notched, and of moderate size; head not wider than thorax.
F. All the palpi enlarged at the tip; body coarsely punctured and very hairy; antennal club triangular..........TRICHODES, 6.
F F. Only the labial palpi enlarged; body moderately punctured and hairy; antennal club long and loose..........CLERUS, 29.
E E. Eyes very large and entire; head much wider than the thorax..........HYDNOCERA, 22.
A A. Tarsi 4-jointed; thorax with a narrow but distinct lateral margin.
G. Antennæ strongly serrate at the end..........ENOPLIUM, 4.
G G. Antennæ terminating in a 3-jointed flattened club..........NECROBIA, 5.

The genera Clerus and Hydnocera are the most numerous in species, some of which are sufficiently common. *Clerus*, Geoffroy, with which we include *Thanasimus*, Latr., and *Thaneroclerus*, Spin., contains a number of prettily marked species, which are sometimes seen running over prostrate logs in the forest, in search probably of small wood-eating larvæ. The *Clerus dubius*, Fab., is a little more than three-tenths of an inch long, of a steel-blue color, the elytra crossed by three orange bands. The *C. nigrifrons*, Say, is upwards of two-tenths, of a tawny yellow color, the elytra cinereous behind, including a broad black band; there is a black spot on the front, and the venter is black. *C. nigripes*, Say, is very similar, but the frontal spot is wanting and the venter is red. The *C. sanguineus*, Say, is of the same size as the last, with the thorax brown and the elytra scarlet.

The Hydnoceræ are small and obscure insects, less than a quarter of an inch in length, but easily distinguished by their large prominent eyes, which cause the head to be wider than the thorax. They are often beaten from the leaves of forest trees.

The genus *Trichodes*, Herbst, contains a number of very hairy and prettily banded species, the larvæ of which devour the larvæ of certain kinds of bees. Some are found in the nests of the mason-bees, and the European *T. apiarius* has been known to be very destructive to the hive-bee.

The *Necrobia violacea*, Oliv., a small dark-blue or greenish beetle, three-twentieths of an inch in length, has been imported from Europe.

It is sometimes found in houses, but more commonly on the carcases, and especially the bones, of dead animals. The have even been found under the wrappings of Egyptian mummies. The *N.* (*Corynetes*) *rufipes*, DeGeer, has also become spread over the whole globe.

Section II. *HETEROMERA.*

Five joints in the anterior and middle tarsi, and four joints in the hind tarsi, the joints being usually slender and bare, or at most, sparsely haired or spinous.

The Heteromera constitute the second principal division of Coleopterous insects, distinguished primarily, as the name implies, by the diverse number of joints in their tarsi, or feet. This character is remarkably uniform, only two or three exceptional cases having been detected in all the known insects of this section; and as but few of them are of very small size, the number of tarsal joints is usually easily determined. It is also seen by the above formula that the tarsal joints in the insects of this, as of the preceding section, are usually slender and clothed, at most, with scattered hairs or bristles, thus strongly contrasting with the dilated brush-like and bilobed tarsi of the two succeeding sections.

This section embraces an extensive series of beetles, though less numerous than the first and third sections. Although most of them are vegetable feeders, at least in the imago state, comparatively few subsist upon growing plants, and but few, even of these, have been known to increase to such an extent as to become injurious to cultivated crops. The principal exceptions to this statement are the common meal-worms belonging to the genus Tenebrio, and the Lyttæ or Cantharides, which are sometimes seriously destructive to the foliage of vegetables, especially that of the potato.

The Heteromera comprise two very diverse groups of beetles, which have, indeed, scarcely any characters in common except the number of tarsal joints.

The first division, of which the well known Cantharides may be taken as the leading type, is distinguished by having the head wider than the anterior part of the thorax and attached to it by a short neck; by the elytra being comparatively thin and flexible; by their frequently diversified colors; their active diurnal habits; and the parasitic character of many of their larvæ.

The other section, which may be represented by the common black Tenebrio or meal-beetle, is distinguished from the foregoing by having the head partially immersed in the thorax; their hard and inflexible elytra; their obscure and mostly black or brown colors; and by their being vegetable feeders in both the perfect and the larva states.

The first of these divisions contains a considerable number of sufficiently distinct and well marked families; but many of the minor groups of the second division are so intimately connected by intermediate grades, that Lacordaire and other recent authors have united a large proportion of them in one large family under the name of *Tenebrionidæ*.

In accordance with our plan of classifying insects as nearly as possible according to their habits and the nature of their food, we will divide the Heteromera into four tribes, as follows:

A. Head as wide as the thorax, and attached to it by a visible neck. Body rather soft and elytra flexible: anterior coxæ large, conical and contiguous; colors often diversified. Larvæ mostly carnivorous and many of them parasitic:
Tribe 1st (or 12th), *Parasitic beetles.*

A A. Head without a distinct neck, narrower than the the thorax, and more or less inserted in it; body firm; coxæ never very prominent: colors usually black or brown; habits never carnivorous.

B. Anterior coxæ moderately prominent and nearly or quite contiguous: antennæ slender and filiform; color usually brown, sometimes black. Larvæ live under bark of decayed trees:
Tribe 2d (or 13th.) *Bark beetles.*

B B. Anterior coxæ small, depressed and separate: antennæ usually moniliform, or sub-clavate and perfoliate.

C. Antennæ usually more or less moniliform, and often a little thickened towards the tip, and as long as the head and thorax. Color almost always black; habits terrestrial:
Tribe 3d (or 14th.) *Heteromerous ground-beetles.*

C C. Antennæ usually shorter than the head and thorax, and strongly clavate and perfoliate; head of males often with two horns. Colors brown or dark metallic, sometimes black with red spots. Habits fungivorous:
Tribe 4th (or 5th.) *Heteromerous fungus-beetles.*

TRIBE XII.

PARASITIC-BEETLES.

Heteromera parasitica. TRACHELIDES, Latreille.

The name *Trachelides*, from a Greek word meaning *a neck*, was given to these insects by Latreille to express their most striking character, that of having the head attached to the thorax by a visible neck; whereas in most beetles the head is inserted in the thorax nearly or quite to the eyes. The exceptions to this rule, however, in the Coleopterous order, are not very uncommon, of which the families of Telephoridæ, Lepturidæ, and portions of the Carabidæ, are some of the most conspicuous examples. But the name was intended to contrast them more particularly with the other beetles of the heteromerous section.

The antennæ, in all the Trachelides are of nearly or the same width throughout, sometimes simple or filiform, sometimes serrate, and sometimes pectinate or branched, especially in the males. The elongated coxæ permit great freedom of motion to the legs; and their frequently bright or diversified colors show that they live exposed to the light of the sun. Accordingly we find that in their matured state they are active diurnal insects, often frequenting plants and flowers.

We have designated the insects of this tribe as *parasitic beetles*, a title which preeminently, but not exclusively belongs to them. The term parasite literally means one who sits at the table of another, and lives at his expense, and is now very commonly applied to those insects which either inhabit the nests of other insects and subsist upon the food prepared by them, or which infest the bodies of other insects, feeding upon their substance, and ultimately causing their death. This parasitism is found to be very extensive in the insect world, and to constitute one of the most efficient agencies by which the excessive increase of many kinds of insects is kept in check. The great majority of parasitic insects is found in the order of Hymenoptera, where they comprise some of the most numerous of the families of insects. In the order of Coleoptera the parasitic species are comparatively few, and outside of the present tribe, are mostly limited to a small number of minute species in the families Staphylinidæ, Pselaphidæ and Scydmænidæ. The parasitic character is therefore the more distinctive of the present tribe, most of the families of which are parasitic in their larva state; though it is pretty well determined that a few of them are lignivorous, and the larvæ of some of the families are but little known. The Lagriidæ and Anthicidæ, from certain observations which have been made upon them, are supposed to be carnivorous, and Latreille considered the latter to be parasitic. The Rhipiphoridæ, Stylophidæ, and Meloidæ, including the subfamily of Horiides, are known to be parasitic. The larvæ of the Pyrochroidæ and Mordellidæ are found in wood, upon which, therefore, they are supposed to feed. Mr. Riley has found the *Mordella 8-punctata*, and its larvæ, (Fig. 50) in very rotten oak stumps, and he states there can be no doubt of its lignivorous habits, as he has found the larvæ in their own burrows, extending through the wood in all directions. He has likewise bred a smaller species from the green stems of ambrosia, and other herbacious plants. In a strict classification according to the habits, therefore, the Pyrochroidæ and Mordellidæ would require to be separated from the parasitic families, but there appear to be no organic characters which these two families possess in common, which authorizes us in placing them in a tribe by themselves.

It is one of the many remarkable facts in the natural history of insects that the same species often differs greatly in its habits and the nature of its food, in the different stages of its existence. We have had occasion to refer to some of the most common instances of this change in the introductory part of this work, and the same is strikingly illustrated in the history of the present tribe, in which the same species is often parasitic in its larva state, whilst it feeds upon the flowers or foliage of plants in its perfect or imago state.

The following is a table of the families of the Trachelides:

A. Constriction of the neck gradual and slight; anterior coxal cavities closed behind.* Size medium. ....LAGRIIDÆ.
A A. Neck distinct and abrupt; anterior coxal cavities always open behind.
  B. Thorax with a lateral margin; abdomen usually tapering to a long point; hind legs long and flat. Size small..............................MORDELLIDÆ.
  B B. Thorax rounded at the sides; abdomen not pointed.
    C. Tarsal claws deeply cleft. Size large or medium.................MELOIDÆ.
    C C. Tarsal claws entire.
      D. Thorax narrower behind than the elytra.
        E. Antennæ almost always filiform and simple. Size very small.ANTHICIDÆ.
        E E. Antennæ usually branched in the male, serrate in the female. Size medium or small................................PYROCHROIDÆ.
      D D. Thorax as wide behind as the elytra. Size small.......RHIPIPHORIDÆ.
A A A. Without visible neck—structure very abnormal. Size very small.STYLOPIDÆ.

Family XLII. LAGRIIDÆ.

This family is comprised of a small number of medium sized beetles, which furnish a connecting link between the Trachelides and the Tenebrionidæ; having an imperfect neck, and being rather soft and flexible like the former, but having the anterior coxal cavities closed behind, like the latter. Mr. Westwood states that he has found the larva of the European *Lagria hirta* on white thorn hedges; and Lyonet mentions having discovered the same under dead leaves upon the ground.

There are but five N. A. species of this family. The *Lagria (Arthromacra) ænea*, Say, is an elongate brassy-black beetle, nearly half an inch in length, and easily recognized by the remarkably elongated terminal joint of the antennæ, which is as long as the four preceding joints taken together.

Family XLIII. MORDELLIDÆ.

This family contains a considerable number of small beetles, rarely more, and usually less than a quarter of an inch in length, and distinguished by their elliptical and arched form, the head being bent down much below the level of the thorax, and by the abdomen usually terminating in a considerably prolonged point. They are, moreover, the only Trachelides which have the upper part of the thorax separated from the lower, on the sides, by a prominent liné or margin. The tarsal claws are small, but when strongly magnified they are usually found to be prettily serrated on their lower edge. Their colors are mostly black or slate color, but some of them are slightly variegated with whitish or rufous. The perfect insects are usually found upon flowers, and some of the species are very common. The larvæ have been found in the rotten wood, and in the pith of various plants, upon which they are therefore supposed to feed; and we have already referred to Mr. Riley's observations upon the larvæ of *M. 8-punctata*, which he found in old oak stumps, under circumstances which seemed to preclude the supposition of their being otherwise than lignivorous in their diet.

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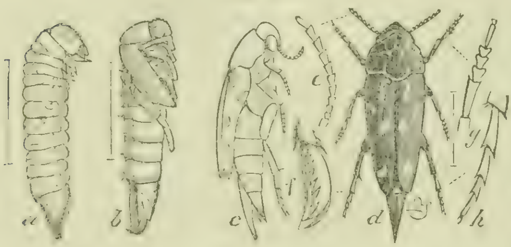
* The state of the anterior coxal cavities as respects their being closed or open behind, is a character of considerable importance in classifying the Coleoptera, especially the Heteromera. The coxal cavities are the hollows in the sternum or breast plate in which the legs are inserted. The anterior cavities are sometimes wholly surrounded by the crust of the sternum, when they are said to be closed; in other cases there is a deficiency of the sternum directly behind the anterior coxæ, which is filled by membrane, and the cavity is then said to be open.

[Fig. 50.]



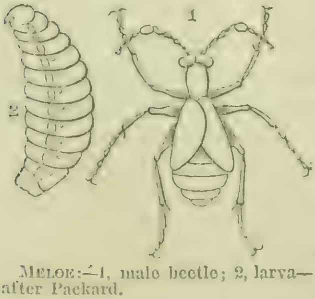
MORDELLA 8-PUNCTATA, Fab.:—*a*, larva; *b*, pupa; *c*, beetle, outline side view of female; *d*, dorsal view of same; *e*, antenna; *f*, the serrated tarsal claw of same, highly magnified—after Riley.

It would seem, therefore, that in a natural classification of the Coleoptera according to their food-habits, the Mordellidæ should be separated from the parasitic Trachelides, and united with the heteromerous bark-beetles, which they also resemble in some of their organic characters, such as their proportionally smaller heads, margined thorax, and sombre colors. In this case their location would be adjoining the Cistelidæ, which they resemble in the peculiar character of their serrated claws.

There are upwards of ninety described N. American species of this family, most of which are contained in genera Anaspis and Mordella, the former being distinguished by not having the abdomen prolonged to a point.

Family XLIV. MELOIDÆ.

[Fig. 51.]



MELOE:—1, male beetle; 2, larva—after Packard.

This family contains the well-known Lyttæ or Cantharides. They have elongated flexible bodies, with a very distinct neck, and with the claws deeply cleft, the upper portion being often pectinate, or comb-toothed. They are rather large or medium-sized insects. Our most common species are blackish or ash-colored, but some are prettily striped, and others are richly variegated with green and yellow. The larvæ, so far as known, are parasitic in the bodies or in the nests of bees. Their history was long involved in obscurity, but the development of the larvæ of the genus Meloe has been satisfactorily elucidated by Newport, Siebold and other modern observers. It appears that the parent beetles deposit their eggs in the nests of various kinds of bees, but especially those of the humble-bees. The young larvæ are sometimes found in the nests, but usually upon the bodies of the bees, from which they draw their nutriment. Infested bees, observed in confinement, have been seen to become exhausted by these larvæ, thus proving them to be genuine parasites. The following are the principal genera:

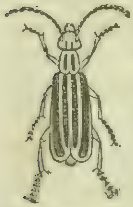
A. Elytra much shorter than the abdomen, separate at their tips, and usually lapping one upon the other at base .... Meloe, 11 sp.
A A. Elytra covering the abdomen.
  B. Head large, front not prolonged beyond the base of the antennæ; frontal suture wanting: Horia, 3.
  B B. Head moderate, front somewhat prolonged, and with a distinct suture.
    C. Mandibles long and acute; maxillæ greatly elongated.................... Nemognathus, 28.
    C C. Mandibles short and obtuse; maxillæ norman.................................. Lytta, 99.

The genus *Meloe*, Linn., is alluded to by Kirby as apparently forming a connecting link between the Coleoptera and the Orthoptera, having the head vertical, and the elytra lapping at base, but the resemblance is very remote. The inferior or true wings are wanting, and these insects are found on the ground, where they feed upon herbaceous plants, mostly those of the genus Ranunculus. The females become so swollen with eggs that they drag their abdomens with difficulty along the ground. When captured they exude a yellow oily fluid from the joints of their legs, whence they have received the popular name of *oil-beetles*. They vary in length from half an inch to an inch, and are either black or of a dark violet-blue color. Our most common species is the *Meloe angusticollis*, Say, of a violaceous color, the female upwards of three quarters of an inch in length; the male is considerably smaller, and has the antennæ remarkably swollen and knotted in the middle.

We have two species of the genus *Horia*, Fab., both of which are extremely rare. They are found in ants' nests. The *H. sanguinipennis*, Say, is four-tenths of an inch long, black, with light red elytra.

The genus *Nemognatha*, Illiger, is remarkable for the elongation of the outer lobe of the maxillæ into a long setaceous proboscis, very similar in appearance to that of the honey-bees in the hymenopterous order. These insects are found on flowers, the honey of which they probably extract. We have seen a somewhat similar structure to exist in the genus Chauliognathus, in the family of Telephoridæ; but here the organ is soft and elastic, and capable of being retracted within the cavity of the mouth.

[Fig. 52.]



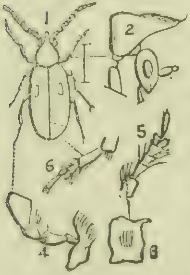
LYTTA VITTATA, Fabricius.

The genus *Lytta*, of Fabricius, or *Cantharis*, of Geoffroy, contains the blistering beetles of the shops, and also the well-known ash-colored, black, and striped potato-beetles. Some entomologists divide them into two groups or subgenera: *Lytta* proper, in which the antennæ are almost moniliform, and a little thicker towards the tip, and *Epicauta*, in which the antennæ are filiform, or a little tapering, with the joints elongated. The latter group contains all our common species.

Family XLV. ANTHICIDÆ.

This family, founded upon the genus *Anthicus*, a Greek word, meaning *variegated*, is of moderate extent, and is composed of very small, prettily colored beetles, never much exceeding an eighth of an inch in length. They are readily distinguished from most other small beetles by their narrow necks. Some of them bear a striking resemblance to ants, and others are remarkable for a prominent horn on the top of the thorax. The larvæ are unknown, but some observations of Latreille led him to believe that they are parasitic. The perfect insects are found on flowers and leaves.

[Fig. 53.]



NOTOXUS:—1, beetle; 2, front of body seen laterally; 3, mandible; 4, maxillary palpus; 5, 6, tarsi—after Westwood.

Most of our species are found in the three following genera:

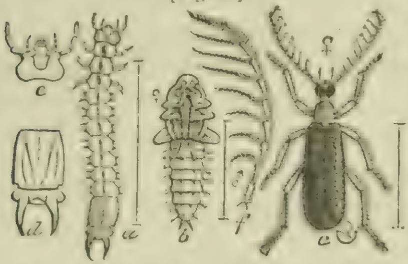
A. Eyes notched, hairy, and coarsely granulated.................XYLOPHILUS, 6 sp.
A A. Eyes oblong and entire.
  B. Thorax prolonged over the head in the form of a horn.................NOTOXUS, 15.
  B B. Thorax without horn.................ANTHICUS, 50.

The curious little *Notoxus monodon*, Fab., is not an uncommon insect. It is of a brownish-yellow color, with a black band across the middle of the elytra, and two spots of the same at the base, and an obscure one at the tip. The horn on the thorax projects forwards so as to cover the head. Another, but less common species, is the *N. bicolor*, Say. The head and thorax are yellowish, and the elytra are blue-black. The genus Anthicus is much the most numerous in species.

Family XLVI. PYROCHROIDÆ.

The species of this family are few in number, and are most conspicuous for the usually branched antennæ and their common style of coloration, which is that of a red thorax contrasted with the black elytra. They are of medium size, varying from one-third to three-fourths of an inch in length. The name is derived from the genus *Pyrochroa* of Geof-

[Fig. 54.]



DENDROIDES CANADENSIS, Latr.:—*a*, larva; *b*, pupa; *c*, beetle (female); *d*, enlarged anal horns; *e*, enlarged head of larva; *f*, antenna of male magnified—after Riley.

froy, a word which means *flame colored*, and which was obviously suggested by the prevalence of red or yellow in their coloration; some of the foreign species being almost wholly red. An example of the larvæ is exhibited in the accompanying figure of the larva of Dendroides. These larvæ are found under the bark of decayed trees and stumps, and are supposed to be lignivorous.

The following are the three principal genera:

A. Antennæ flabellate or pectinate.
  B. Eyes very large, nearly contiguous..DENDROIDES, 4 sp.
  B. B. Eyes moderate and distant..PYROCHROA, 2.
A. A. Antennæ simple..PEDILUS, 14.

The *Pyrochroa flabellata*, Fab., is from five to six-tenths of an inch in length, of an elongated and somewhat flattened form with parallel sides. The head and thorax are yellow, and the elytra blue-black. The *Denroides canadensis*, Latr. (Fig. 54) is somewhat similar but a little smaller and the elytra are of a dull or brownish-black color. Both of these insects are rather common about decayed trees, under the bark of which the larvæ reside. The antennæ are flabellate in the males, and pectinate in the females. The species of *Pedilus* are mostly between two and three-tenths of an inch in length, and usually exhibit the reddish thorax and black elytra, so characteristic of the family.

Family XLVII. RHIPIPHORIDÆ.

This is a small family the species of which are distinguished by having the elytra usually shorter than the abdomen, and somewhat narrowed and separated from each other behind. the thorax is narrowed in front, but as wide at base as the elytra, in which they differ from all the other Trachelides except the Mordellidæ, with which they are united by some authors. But the different habits of the larvæ confirm the propriety of their separation. The perfect insects are found on flowers. The larvæ are parasitic in the nests of wasps, and a foreign species is known to infest the bodies of cockroaches.

Twenty-two N. A. species have been described.

Family XLVIII. STYLOPIDÆ.

A family of minute insects of so anomalous a character that it is very difficult to determine their proper location in the natural system. But few species are known, all of which are parasitic in the bodies of bees. Five genera have been described, two of which have been found in N.

America: *Stylops*, Kirby, with the antennæ six-jointed; and *Xenos*, Rossi, having the antennæ four-jointed. For a detailed description of these insects the reader is referred to Westwood's Introduction, Vol. II, page 287; or to Packard's Guide, page 481.

Tribe XIII.

HETEROMEROUS BARK-BEETLES.

Heteromera corticicola. STENELYTRA *partly*, Latreille.

This tribe includes all the Stenelytra of Latreille except the family of Helopidæ, which are now united to the Ground-beetles. The word *Stenelytra* means having *narrow wing-covers*, and was given to these insects on account of their more or less elongated and narrow forms. They are distinguished from the parasitic beetles by the absence of a visible neck and by the head being narrower than the thorax; and from the two following tribes by the usually longer and more slender antennæ, by the anterior coxæ nearly or quite touching each other, and by their coxal cavaties being open behind, except in Cistelidæ where they are slightly closed. The larvæ of all these insects are found under the bark or in the decayed wood of trees which have been long dead. The perfect insects are generally found in the same situations, but some, especially the Cistelidæ, are often seen upon leaves or flowers.

The following are the families of bark-beetles:

A. Thorax rounded at the sides, or without a sharp lateral margin, narrower behind than in front, and narrower at base than the elytra.
  B. Head gradually narrowed behind, and usually somewhat prolonged in front; last joint but one of tarsi slightly bilobed................ŒDEMERIDÆ.
  B B. Head not narrowed behind; sometimes prolonged in front into a snout; tarsi entire..PYTHIDÆ.
A A. Thorax with a lateral margin, not narrowed behind, and usually as wide at base as the elytra.
    C. Maxillary palpi terminating in a hatchet-shaped joint; claws serrate: CISTELIDÆ.
    C C. Maxillary palpi usually long and pendulous, with all their joints more or less enlarged; claws simple......................MELANDRYIDÆ.

Family XLIX. ŒDEMERIDÆ.

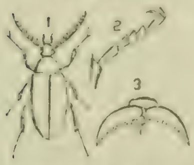
A small family of heteromerous beetles, with elongate, narrow bodies, the head and thorax somewhat narrower than the elytra, and rather long filiform antennæ. The elytra in some of the foreign species are narrowed and separated behind. Our most conspicuous species is the *Nacerdes melanura*, which is more than half an inch in length, of a yellowish-brown color, with the elytra tipped with black.

Family L. PYTHIDÆ.

Another small family containing less than a dozen North American species, the most remarkable of which belong to the genus Salpingus, which differs from all other Coleoptera except the Curculionidæ, in having the head prolonged in front in the form of a snout, sometimes of considerable length. The two leading genera are *Pytho*, Latr., and *Salpingus*, Illiger.

Family LI. CISTELIDÆ.

[Fig. 55.]



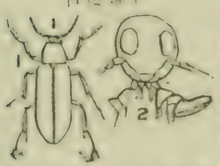
CISTELA:—1, beetle; 2, tarsus; 3, tarsal claw —after Westwood.

This is a family of considerable extent, and some of the species are amongst our most common insects. They are smooth, oval beetles, of moderate or rather small size, and are generally clothed with minute hairs, which give a silken gloss to the surface. Their most distinctive character is the pectinate or comb-toothed claws at the end of the tarsi. This, like most other minute characters, can be best seen by holding the insect up against the light of a window and examining it through a lens. This character is very rare in the Coleoptera, and therefore quite distinctive where it occurs. We have already seen it to exist in the genus *Lebia* and a few other Carabidæ, and a modification of it occurs in the families Meloidæ and Mordellidæ.

Our most common species of Cistelidæ are plain, brownish beetles without spots. Thirty-five species have been described, most of which are contained in the genera *Cistela** and *Allecula* of Fabricius; the former having merely simple tarsi and the latter having the anterior tarsi somewhat dilated, and all of them with the penultimate joint bilobed.

Family LII. MELANDRYIDÆ.

[Fig. 56.]



MELANDRYA:—1, beetle; 2, head of SERROPALPUS, showing large size, and deflexed nature of the three terminal joints of the maxillary palpi—after Westwood.

The insects of this family were called Serropalpi by Latreille, to express their most remarkable character: that of having the joints of the maxillary palpi—which are usually long and pendulous—more or less enlarged in the form of saw-teeth, the last joint being the largest, and usually hatchet-shaped. It is a family of moderate extent, containing forty-five N. A. species. They never much exceed half an inch in length, and some are less than half that length. Their colors are black or brown, and some of those of the latter color are ornamented with yellow markings.

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* This name—derived from the Greek *kiste*—a *chest*, appears to have been given originally by Geoffroy to the insects of the genus *Byrrhus*, Linn., to the short and thick bodies of which it was not inapplicable. But Linnæus having given the name Byrrhus to this genus, the name Cistela was transferred by Fabricius to the present group of heteromerous beetles, where it has now become established by general acceptance and long usage.

The following are the principal genera:

A. Head without a neck.
  B. Antennæ with the four last joints abruptly enlarged..TETRATOMA.
  B B. Antennæ filiform or slightly and gradually enlarged.
    C. Anterior coxæ contiguous.
      D. Middle coxæ contiguous, with distinct trochantins..................................MELANDRYA.
      D D. Middle coxæ separate, without trochantins...SERROPALPUS.
    C C. Anterior coxæ separate.
        E. Head horizontal...SYNCHROA.
        E E. Head vertical.................................EUSTROPHUS, HALLOMENUS, ORCHESIA.
A A. Head with a short neck; eyes coarsely granulated and deeply notched..............SCRAPTIA.

We have space to refer to only a few of the most noticeable species. We have two species of Tetratoma, which depart from the ordinary habits of the family by being inhabitants of fungi. The *Melandrya striata*, Say, is six-tenths of an inch long, pure black, the thorax with a middle furrow, and a depression on each side, and the elytra deeply striate and punctate. *Serropalpus 4-maculatus*, Say, is a third of an inch in length, of a deep brown color, with two angular yellow spots on each elytron. *Hypulus trifasciatus*, Melsh, is quarter of an inch or less in length, yellow, with three irregular brown bands across the elytron. These, like the other species of the family, are found under the loose bark of trees in an advanced state of decay. One of the most common larvæ found in such situations is that of the *Synchroa punctata*, Newm., a plain light-brown species about half an inch in length. This larva is of an elongate cylindrical form, with six short legs, and two horny points at the posterior extremity of the body.

The genus *Penthe*, of Newman, is placed in this family by LeConte, but in the sub-family of Helopides by Lacordaire. The palpi are rather long and robust, but not hatchet-shaped at the end like most of the Serropalpi. It contains two rather large, oval, depressed beetles, upwards of half an inch in length, and of a deep black color: the *P. obliquata*, and the *P. pimelia*, of Fabricius; the former being distinguished by having the scutellum clothed with rust-red hairs. They are common species, being found under the bark of decayed trees and in rotten stumps. Their sub-cortical habits furnish an argument for retaining them in the present tribe.

TRIBE XIV.

HETEROMEROUS GROUND-BEETLES.

Heteromera terricola. MELASOMA, Latreille.

This tribe contains a large and diverse assemblage of beetles, distinguished chiefly by their heteromerous tarsi, their usually slightly clavate and moniliform antennæ, and their uniformly dark or black coloration. The above name of Latreille, meaning *black-bodied*, is expressive of this character. As a general rule they are rather large beetles, many of them being above the medium size, and few much below it. They are found almost exclusively upon the ground, and mostly in sandy situations. Scarcely any observations appear to have been made respecting the food-habits of these beetles, with the exception of a few common species which inhabit houses and granaries, the larvæ of which are sometimes seriously injurious to flour and meal of different kinds. The larvæ of a few species have been found in rotten wood. All the known larvæ are very similar in form and structure, and are well represented by the common meal-worm which is the larva of the *Tenebrio molitor*, Linn. This is a long, slender, cylindrical grub, of a wax-yellow color, and a hard consistency. In its motions it seems to drag its body along by means of the six short legs attached to the three anterior segments, its comparative inflexibility incapacitating it for the vermicular motion by which the softer larvæ effect their progression.

A comparatively small proportion of the insects of this tribe inhabit the northern and eastern sections of this country. Their geographical center is in the tropics, and they constitute a leading feature in the insect fauna of California, and other portions of the Pacific slope.

The several groups of which this tribe is composed are found to pass so insensibly into each other, when the species from all parts of the world are compared together, that Lacordaire, in his great work on the genera of Coleoptera, unites them all in the one large family of Tenebrionidæ, in which he also includes the fungus-beetles (*Diaperidæ*). In this course he has been followed by our own distinguished coleopterist, Dr. John L. LeConte, and more recently by Dr. George H. Horn, of Philadelphia, who has published an elaborate monograph of the N. A. species of this family.

In speaking of the unusual difficulties which are met with in classifying this tribe of insects, M. Lacondaire makes some remarks which are so pertinent to the case, and at the same time so comprehensive, that we here introduce them:

"Our classifications of insects are based, not upon isolated characters, but upon combinations of characters. In order that they may admit of easy application it is necessary that the characters thus combined shall be neither too many nor too few. There are some families, such as the Elateridæ, where the latter is the case: they are too homogeneous. Others, even more numerous, as the Carabidæ, for example, hold a just medium in this respect: their species possessing a common basis of organization which is stable, or which varies but little. We here, therefore, have to deal with a restricted number of organs, which admit of only a moderate quantity of combinations. From this it results that the groups superior to genera can be characterized in a few words, and their limits are, in general, sufficiently well defined. With the Tenebrionidæ, on the contrary, an instability without limit is the rule; not a single organ, even the most insignificant, escapes. If, as we ought, we take all of them into account, the number of combinations to which they give rise is so great that it is impossible to bring any of them to the front, and for each group we are obliged to pass in review almost the entire organization. If to this we add the insensible transitions between the forms of organs which are themselves equally unstable, we shall understand how the groups thus constituted absolutely refuse to admit of any precise definition." Vol. V, p. 289.

But, notwithstanding the difficulty of dividing this tribe into minor groups by any sharp lines of demarkation—a difficulty which we are continually encountering, in a greater or less degree, in all our attempts at generalization in natural history—they may still be arranged in several divisions which will facilitate the determination of species. Thus regarded, this tribe will constitute the family of Tenebrionidæ, which can be divided into several minor groups which will take the rank of sub-families.

Family LIII. TENEBRIONIDÆ.

This family having been already sufficiently described in treating of the tribe which it constitutes, we proceed to designate the sub-family into which it may be divided:

A. Antennæ longer than the head and thorax united, slender and of nearly or quite the same width throughout; front separated from the labrum by a membranous clypeus; body often with a metallic or brassy tint..........HELOPIDES.

A A. Antennæ usually about as long as the head and thorax united; gradually enlarging towards the tip, and with the joints usually more or less round or moniliform; front articulating directly with the labrum; color black: TENEBRIONIDES.

A A A. Antennæ usually shorter than the head and thorax united, with joints wider than they are long, or more or less perfoliate; middle coxæ without trochantins; color generally brown..........................ULOMIDES.

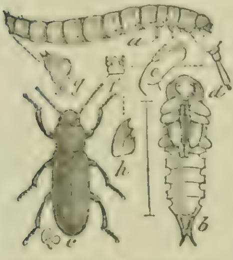
Sub-family HELOPIDES.

The name Helops appears to have been originally given to a harmless species of serpent, but was appropriated by Fabricius to a sub-division of the coleopterous genus Tenebrio, of Linnæus. We use the family name here in a comprehensive way to include a considerable number of species distinguished from the Tenebrionidæ proper by the characters given in the foregoing table. The larvæ resemble those of Tenebrio, and are found in rotten wood. The perfect insects are sometimes found upon the ground. They are usually of a medium size. The following are the principal genera:

A. Lateral and anterior margins of the front continuous; body oval; sides of the breast beneath, often striated longitudinally........................HELOPS, 24 sp.
A A. Lateral margin of the front elevated, oblique, and abbreviated.
  B. Body elongated........................STRONGYLIUM, 2.
  B B. Body very convex........................MERACANTHA, 1.

Sub-family TENEBRIONIDES. *Darkling beetles.*

[Fig. 57.]



TENEBRIO OBSCURUS, Fab.:—*a*, larva; *b*, pupa; *c*, beetle; *d*, antenna of larva; *e*, maxillæ; *f*, labium; *g*, terminal segment, showing the dual proleg fully extended, of same—after Riley.

Founded upon the genus Tenebrio, of Linnæus, a name derived from the Latin *tenebræ*, meaning *darkness*, and given to these insects on account of their universally black color. The family is very extensive, but, as formerly remarked, the great majority of N. American species inhabit the western slope of the continent, but some species are found in great abundance upon the arid plains which extend eastward from the base of the Rocky mountains. The typical and most common species is the *Tenebrio molitor*, a plain black beetle, six-tenths of an inch in length, whose hard, wax-colored larva is often found upon the floor where grain and meal are stored. Most of these insects are found on the ground, but some live under the bark of fallen and decaying trees. The following are some of the principal genera:

A. Ventral segments entirely horny; tarsi spinous beneath.
  B. Middle coxæ without trochantins........................ZOPHERUS.
  B B. Middle coxæ with distinct trochantins.
    C. Thorax transversal, its hind angles prominent and embracing the base of the elytra.....ASIDA.
    C C. Thorax heart-shaped, its hind angles not prolonged........................PELECYPHORUS.
A. A. Ventral segments 3 and 4 with the hind margin membranous.
    D. Elytra embracing widely the sides of the abdomen; tarsi bristly beneath..BLAPS. ELEODES.
    D D. Elytra not embracing widely the sides of the abdomen.
      E. Eyes divided in two by the margin of the head; tarsi bristly beneath.........BLAPSTINUS.
      E E. Eyes not divided.
        F. Tarsi with a silky golden pubescence beneath........................UPIS.
        F F. Tarsi with coarse pubescence........................TENEBRIO.

The general remarks made in describing the present tribe, apply particularly to the numerous species of this sub-family.

Sub-family ULOMIDES.

This sub-family includes a small number of heteromerous beetles, which are closely allied to the Tenebrionides in their general characters, but differ from them chiefly in their shorter and more or less perfoliate antennæ, the absence of trochantins in their middle legs, and their usually reddish-brown color. The anterior tibiæ are more or less dilated, and sometimes toothed on the outer edge, and the last tarsal joint is often as long as all the others united. They are mostly found under the bark of dead or decaying trees. The larvæ of some foreign species of Uloma have been found in flour and in bake houses, like those of Tenebrio proper. The species of the genus Hypophlœus, as the name implies, live under the bark of trees. These, which are our two most common and typical genera, may be thus distinguished:

A. Labrum attached directly to the front; anterior tibæ dilated and toothed on the outer edge; size about medium .... ULOMA.

A A. Labrum separated from the front by a membranous clypeus; anterior tibæ somewhat widened but without teeth; size small .... HYPOPHLŒUS.

Uloma contains five N. American species. The *U. impressa*, Melsh, is a common insect, found in old logs and stumps in an advanced stage of decay. It is between four- and five-tenths of an inch in length, and of a deep mahogany-brown color. It was formerly considered identical with the *U. culinaris* of Europe. The *U. imberbis* and the *U. punctulata*, Lec., are similar, but only about three-tenths of an inch long, and of a lighter color. The former is distinguished by having the last joint of the antennæ obliquely truncated and pointed. The other two species have not been found east of the Mississippi river. Hypophlœus contains three species. They resemble Uloma in form and color, but are only about three-twentieths of an inch in length.

TRIBE XV.

HETEROMEROUS FUNGUS-BEETLES.

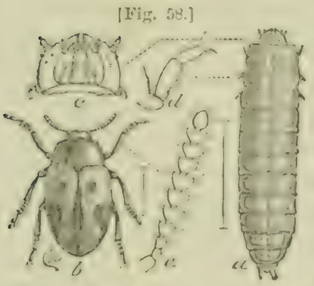
Heteromera fungicola. TAXICORNES *mostly*, Latreille.

The insects of this small tribe so closely resemble the heteromerous ground beetles in their organic details, that they are merged by Lacordaire in his comprehensive family of Tenebrionidæ. They are, however, usually easily distinguished by their general form and color, and their short perfoliate antennæ, besides the other characters mentioned in the general description of the tribes of the heteromerous section. But they are especially distinguished by their fungivorous habits. The only other insects in this section which are known to us, in this country, having similar habits, are the two species of Tetratoma, in the family of Melandryidæ.

They are usually found, in all their stages, in the fungi which grow upon trees; but they are sometimes found under decayed bark, where they are supposed to feed upon the small fungi which grow in such situations. They comprise the family Diaperidæ.

Family LIV. DIAPERIDÆ.

[Fig. 58.]



DIAPERIS HYDNI, Fabr.:—*a*, larva; *b*, beetle; *c*, underside of head of larva; *d*, leg of same; *e*, antenna of beetle—after Riley.

This small family is founded upon the genus *Diaperis*, of Geoffroy, a term derived from a Greek word meaning *to pass through*, and suggested probably by the perfoliate character of the antennæ, in which the axis appears to pass through the dilated joints; or, the name may have had reference to the habits of the larvæ, in perforating the fungi upon which they feed. The short and more or less perfoliate character of the antennæ, distinguishes these insects from all the other Heteromera except the sub-family of Ulomides. Their other leading characters have been already described in speaking of the tribe which they constitute. The following are the principal genera:

A. Body somewhat square-shaped and rough. First joint of tarsi very short. (Sub-family *Bolitophagides*) .... BOLITOPHAGUS, 4 sp.

A A. Body oval and smooth. First joint of tarsi usually longer than the second. (Sub-family *Diaperides.*)

B. Antennæ shorter than the thorax, and perfoliate. Last joint of maxillary palpi elongated.

C. Head unarmed. 1st joint of hind tarsi as long as the 2d. Length of body quarter of an inch or upwards. Colors black, with reddish-yellow spots .... DIAPERIS, 2.

C C. Head of the males usually with two horns or tubercles. 1st joint of hind tarsi as long as 2d and 3d united. Length less than ¼ inch. Color black or bronzed green, without spots. Thorax sometimes red .... HOPLOCEPHALA, 2.

B B. Antennæ longer than thorax, almost moniliform. Last joint of maxillary palpi triangular. First joint of tarsi longer than 2d and 3d. Surface often pruinose or mealy; usually without spots .... PLATYDEMA, 14.

The *Bolitophagus cornutus*, Panzer, is one of our most remarkable insects. It is a thick-bodied beetle of a dark wood-brown color, and a rough or tuberculated surface, and varying from less than four to nearly five-tenths of an inch in length. The male is distinguished by two flattened horns on the top of the thorax, which curve forwards, and which are clothed on the under side with an orange pubescense. It is often found under the bark of old stumps and prostrate logs. The genus Diaperis proper is represented in this country by the *D. hydni*, Fab., (Fig. 58,) which is common throughout the Middle and Eastern States. One other species, the *D. rufipes*, Horn, is found in Arizona. *Hoplocephala*, a term meaning *armed head*, in allusion to the horns on the heads of the males, contains two species: the *bicornis*, Oliv., wholly of a metallic-green color, and the *viridipennis*, Fab., similar, but with a red thorax. They are both a tenth of an inch long, or a little more. As the former is described as sometimes having a brownish thorax, it is probable they are only varieties of the same species. *Platydema* contains fourteen species, as indicated in Dr. Horn's Revision of N. A. Tenebrionidæ, of which the four following are the most common: the *americanum* and *excavatum* are shining black species, the latter being distinguished by two short horns on the head of the male; the *flavipes* is known by its bluish pruinose surface and yellow legs; and the *eliptieum*, common in the Southern States, which is readily distinguished by the oblique red spot on the anterior part of each elytron.

Section III. *TETRAMERA.*

Apparently four joints in all the tarsi; the joints dilated and brush-like beneath, with the penultimate usually bi-lobed.

The structure of the tarsi in this section is very uniform, being always composed of four distinct joints, with a faint rudiment of the missing joint at the base of the last. We have seen above that in some very small species of the pentamerous section, one or more of the tarsal joints are rudimental or wanting; but it is a curious fact, which may have some important bearing in the classification of these insects, that in the small Pentamera with deficient tarsi, it is usually the first joint which is in a rudimental state, whilst in the genuine Tetramera it is always the fourth joint that is undeveloped. The joints are dilated and cushioned beneath with a dense brush of hairs (except the Scolytidæ), and the last joint but one is almost always bi-lobed, with the last joint inserted between the lobes. But in some of the Chrysomelides proper, the penultimate joint, though dilated as usual, is entire or only slightly notched at the end. The dilated, cushioned and bi-lobed tarsi are peculiar to the beetles of this section with a few exceptions, and therefore serve readily to distinguish them, independently of the number of tarsal joints. This structure of the feet, as we have elsewhere remarked, seems to be specially adapted to enabling these insects to adhere to the surface of leaves and smooth bark, and accordingly all the numerous species of this section are vegetable feeders. Many of them feed upon foliage, some bore into the trunks or branches of trees, and others feed upon fruits or seeds. This section, therefore, embraces a greater number of species injurious to the agriculturist, than all the other sections combined.

The larvæ vary considerably in the different tribes, and will be described in their proper connections. It may be stated generally, that in those which reside in wood or in fruits the feet are usually wanting, or at most are merely rudimental, whilst those which live upon the surface of leaves have six small but well developed feet.

The beetles with four-jointed feet are divided into four tribes, as follows:

Tribe 1st (or 16th of the whole number). Snout-beetles or Weevils. *Fructivora rostrata.* RHYNCOPHORA, Latreille. Head more or less prolonged into a snout. Antennæ usually capitate, rarely serrate or filiform. Larvæ mostly fructivorous. Families: Bruchidæ, Anthribidæ, Brenthidæ, Curculionidæ.

Tribe 2d (or 17th). Short-horned Wood-borers. *Lignivora brevicornia.* XYLOPHAGA, Latreille. Head without snout; body short and cylindrical; antennæ clavate or capitate, but little longer than the head; larvæ lignivorous. Family: Scolytidæ.

Tribe 3d (or 18th). Long-horned Wood-borers. *Lignivora longicornia.* EUCERATA, Westwood. Body elongated; antennæ long and tapering, usually longer than head and thorax. Larvæ lignivorous. Family: Cerambycidæ.

Tribe 4th (or 19th). Tetramerous Plant-beetles. *Herbivora tetramera.* PHYTOPHAGA, Kirby. Body usually short and rounded; antennæ filiform or slightly and gradually enlarged toward the end. Larvæ herbivorous. Family: Chrysomelidæ, including the sub-families Crioceridés, Galerucides, Eumolpides, Chrysomelides, Cryptocephalides, Hispides and Cassidides.

TRIBE XVI.

SNOUT-BEETLES, OR WEEVILS.

Fructivora rostrata. RHYNCHOPHORA, Latreille.

This tribe of beetles, most of which are comprised in the family of Curculionidæ, is supposed to be the most numerous in species, not only in the class of insects, but in the whole animal kingdom. The only question of the correctness of this estimate would be with respect to some of the families of microscopic animalcula, but here the superiority in number would probably be found to be in individuals only, and not in distinct species. The number of species of Curculionidæ, specimens of which actually exist in the collections of Europe and of this country, does not vary much from 20,000. The number of North American species enumerated in Mr. Crotch's check list of 1873, is 414; and this catalogue undoubtedly falls far short of the whole number, especially of the smaller species.

The prolongation of the head anteriorly, in the form of a slender snout, generally serves to distinguish the beetles of this tribe from all others. But in a considerable number the snout is so short and broad as not to afford a very distinguishing feature. In cases of doubt, therefore, the student must take other characters into account. The most important of these is the usually rudimental state of palpi, and the four-jointed, cushioned, and bilobed tarsi. The antennæ, in the great majority, are knobbed at the end, and geniculate or bent like an elbow near the middle.

The Curculionidæ are generally small beetles, probably not averaging more than a quarter of an inch in length, and a great number being less than half this length. A few of the tropical species, however, are amongst the giants of the beetle tribe, some of them attaining a length of from one to two inches.

The larvæ are soft, white, footless grubs, and almost always inhabit the substance of plants, more especially the fruit in its various forms of seeds, nuts, and pulpy fruits. The larvæ of a few foreign genera, however, (Hypera, Coniatus and Cionus,) live upon the surface of leaves, the pulp of which they devour. These, living exposed to the light, present somewhat variegated colors; and they have two or three simple eyes, or ocelli, on each side of the head. When about to transform, they attach themselves to a leaf or its petiole, and enclose themselves in a thin gauze-like cocoon; a curious anomaly in the Coleopterous order. The larvæ of some of the more minute species belong to the class of leaf-miners, and others inhabit the stems of herbaceous plants, causing them to enlarge into the excrescences known as galls, and which bear a certain resemblance to unripe fruits. As a tribe, therefore, the snout-beetles are pre-eminently the occupants and devourers of fruits, and as other tribes of tetramerous beetles are known by the Greek names of Xylophago, or wood-eaters, and Phytophaga, or plant-eaters, the snout-beetles might be properly styled Carpophaga, or fruit-eaters; but we have retained the name by which they are generally known, and which is so happily expressive of their most distinctive character, namely: Rhynchophora, or snout-bearers.

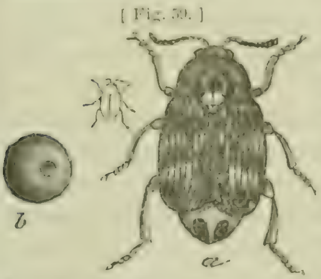
This tribe of beetles comprises the four following families:

A. Labrum and palpi normally developed; antennæ not elbowed; snout short and thick.
  B. Antennæ saw-toothed; eyes notched.............................BRUCHIDÆ.
  B B. Antennæ clavate; eyes round or slightly sinuate.............ANTHRIBIDÆ.
A A. Labrum and palpi obsolete.
  C. Antennæ straight and filiform; proboscis pointing directly forwards; body elongated...BRENTHIDÆ.
  C C. Antennæ clavate and usually elbowed; snout various.....CURCULIONIDÆ.

Family LV. BRUCHIDÆ.

This is a small family of small-sized beetles, always less than a quarter, and sometimes one-eighth of an inch in length. The only tetramerous beetles with which they could be confounded are the Curculionidæ and the Chrysomelidæ; but they differ from the former by having the labrum and palpi of the ordinary form, and the head is but little prolonged anteriorly; and they differ from the great majority of the latter in their short, serrate antennæ, and in having the tip of the abdomen uncovered by the elytra. But a few aberrant genera of Chrysomelidæ,

[Fig. 59.]



Bruchus pisi, Linn.:—*a*, beetle enlarged, the small outline showing natural size; *b*, a pea from which the beetle has escaped—after Riley.

(*Babia*, *Saxinis* and *Coscinoptera*,) resemble them in these characters, thus showing the close relationship between the two families. The present family contains the well known pea and bean weevils, which are often very seriously injurious to these crops. The pea-bugs make their appearance and deposit their eggs in the early part of the summer, and as they have but one brood in a season, we can obtain sound seed by planting peas as late as the first of June.

The family contains but a few genera, and all our injurious species belong to the genus *Bruchus*, Linn.*

The most notorious species are the pea-weevil (*Bruchus pisi*, Linn.): the bean-weevil (*B. obsoletus*, Say), and the grain-bruchus (*B. granarius*, Linn.) The latter is a European species which has been imported in small numbers into this country.

Family LVI. ANTHRIBIDÆ.

This and the following family are really only sub-divisions of the great Curculio family, from which it is distinguished by the presence of an upper lip and palpi, and the straight antennæ. The larvæ inhabit the seeds and stems of plants, and some have short but well developed feet. The larvæ of the genus *Brachytarsus*, which is composed of very small species, are found under the scales of bark-lice, and are supposed to be parasitic, thus presenting a remarkable anomaly in this tribe of beetles. The species are much more numerous than the Bruchidæ, but none of them have proved injurious to cultivated crops. The name is derived from the Greek *anthos—a flower*, and *tribo—to destroy.*

The following are the four principal genera:

A. Thorax with a transverse ridge in front of the posterior margin ....Tropideres, 2 sp.
A A. Thorax without transverse ridge.
  B. Body oblong oval; rostrum with parallel sides.
    C. Anterior coxæ rather widely separated; eyes small and finely granulated......Anthribus, 2.
    C C. Anterior coxæ but slightly separated; eyes large and coarsely granulated...Cratoparis, 3.
  B B. Body short; size small; rostrum cut obliquely.........................Brachytarsus, 5.

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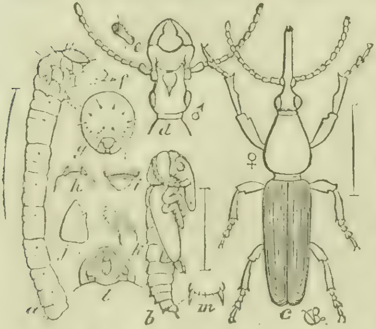
*In Mr. Crotch's Check list the generic name *Mylabris*, of Geoffroy, is substituted for *Bruchus*, Linn. The former term, derived from the Greek *mu-le—a grain-mill*, was applied by the Greeks to some kind of insect found in mills and baking houses, and supposed by some to have been a species of *Blatta*, or cockroach, and by others, the common meal-worm or larva of the *Tenebrio molitor;* but was applied by Geoffroy to the beetles of the present family. A few years later, Linnæus, having overlooked the name given by Geoffroy, re-described these insects under the name of *Bruchus*, also an ancient Greek name of some kind of insect, supposed to have been a species of locust, but which cannot now be determined with certainty. As these insects feed upon grain and other seeds, the name given by Geoffroy has the claim of appropriateness, as well as of priority, but the term *Bruchus* has become established by universal adoption and long continued usage, so that, like many other words, it may be said to have acquired a meaning of its own, independent of its origin.

Family LVII. BRENTHIDÆ.

[Fig. 60.]



EUPSALIS MINUTA :—*a*, larva ; *b*, pupa ; *c*, female beetle ; *d*, head of male do.; *f—l*, leg and head parts of larva ; *m*, end of body of pupa, dorsal view—after Riley.

This, like the preceding family, might be regarded, more properly perhaps, as one of the sub-families of the Curculionidæ. It agrees with them in the important characters of the elongated snout, the undeveloped labrum and palpi, and the spongy and usually bilobed tarsi. It differs from the great majority of them in its non-elbowed antennæ, and the uniform absence of the minute terminal joint, which forms a twelfth or supernumerary joint in the antennæ of many of the Curculionidæ ; and also in the greatly elongated form of the body, especially in some of the foreign species. The family is considerably numerous, upwards of six hundred species being known to exist in cabinets, most of which are found in tropical regions. Indeed only a single species is known to inhabit the continent of Europe, and but three species are found in North America, north of Mexico, and of these only one inhabits the more northern parts of the United States. This is the species commonly known as the Northern Brenthian, which is figured in all its stages in the accompanying cuts. Much interest has become attached to this species from its being the only one of the Brenthian family whose larval history has been traced, and also from the uncertainty in which this history has been involved. In a Report upon the Insects of Massachusetts, published in 1838, Dr. T. W. Harris gave a history of the habits of this insect, together with a description of certain larvæ found in company with the perfect insects, and communicated to him by the Rev. L. W. Leonard of Dublin, New Hampshire. As these larvæ were likewise accompanied by pupæ having the characteristic snout of the Brenthian, bent down between the forelegs, it seemed to be almost demonstrated that the insect in all its stages was here exhibited. But as these larvæ departed widely from the Curculionide type, in having well developed legs, and an anal proleg, subsequent authors have generally held the opinion that some mistake must have occurred in the matter. These doubts have recently been cleared up in Mr. Riley's Sixth Annual Report upon the Insects of Missouri. It therein appears, from specimens communicated to the author by Mr. Wm. R. Howard, of Forsyth, Missouri, that the larvæ of Brenthus do not differ essentially from other Curculionide larvæ. Mr. Riley concludes that the larvæ sent to Dr. Harris by Mr. Leonard, must have appertained to some one of the Tenebrionidæ; similar larvæ having been found by himself in company with the Brenthians, and which he conjectures to be those of the *Strongylium tenuicolle*, Say.

The Northern Brenthus is frequently found under the bark of different kinds of oak, in an incipient state of decay, but the larvæ are genuine wood-borers penetrating into the heart wood, usually of dead, but sometimes of living trees. The beetles vary from one-third to two-thirds of an inch in length. They are of a mahogony-brown color, with the elytra deeply grooved, and marked with linear spots of a tawny-yellow color. The male and female differ remarkably in the shape of the snout, as shown in the accompanying figures.

The species was first described by Drury from a small specimen, under the name of *Brenthus minutus*, and it is now included in the sub-genus *Eupsalis* of Lacordaire, which the author admits to be scarcely distinct from *Arrhenodes*, Sch. It has usually been referred to under the appropriate name of *Brenthus (Arrhenodes) septentrionis*, (or more properly, *septentrionalis*) of Herbst, which is equivalent to the common name of the Northern Brenthus.

Family LVIII. CURCULIONIDÆ.

This is the extensive family of snout-beetles, properly so called. The statements made in describing the tribe of Rhynchophora, of which they compose by far the larger part, had reference chiefly to the Curculionidæ,[*] and need not be here repeated. Their bodies are always of an oval form, never being very much elongated or depressed. The snout varies extremely, being sometimes short and broad, and sometimes as long as the body and almost as slender as a hair. Their most important organic character is the negative one of the absence of the labrum and the rudimental condition of the palpi. Like all the plant-eating Tetramera their tarsi are clothed with a dense brush of short stiff hair on the under side, and the last joint but one is strongly bilobed. Another very distinctive character is the bent or elbowed form of the antennæ, which is caused by the first joint being much longer than the others, and forming an angle with them. The antennæ are almost always knobbed at the end. The larvæ are soft and white, slightly narrowed at each extremity, and usually lying in a curved position. They are always destitute of feet, but in their place we often find little elevations or papillæ which are sometimes surmounted by a coronet of fine bristles. They always occupy the substance of plants, and therefore require but little locomotion. Though they are emphatically the occupants of fruits and fruit-like galls, yet there is no part of a plant which is not inhabited by the larvæ of some one or other of their numerous species.

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[*] *Curculio* was the ancient name of some kind of corn-worm.

The snout-beetles consequently furnish a greater number of species which are injurious to the agriculturist than any other family of beetles. In depositing their eggs the females first puncture a hole with their snouts, then drop an egg at the aperture, and lastly with the aid of the proboscis push the egg to the bottom of the cavity. In harmony with this mode of egg-deposit is the organic character observed in many species, of the female having a proboscis considerably longer than that of the male; of which our Apple-curculio (*Anthonomus 4-gibbus*) furnishes an example.*

The classification of the Curculionidæ, on account of their great numbers and the small size of the great majority of them, taken in connection with the rudimental state of some of the organs, namely, the labrum and the palpi, which, in other insects, often furnish valuable generic characters, presents a difficult study which will tax both the patience and the ingenuity of the student.

They are divided primarily into two large sections, according to the length of the rostrum or snout, and the point of insertion of the antennæ, and designated as the Brevirostres or short-snouted Curculios, and the Longirostres or long-snouted Curculios. These sections not being sharply separated from each other in nature, Lacordaire has adopted, as the basis of the primary division of the Curculionidæ, the relative position of certain parts of the mouth; but these parts are often so minute and obscure that the characters derived from them are very difficult of application. We have therefore followed the more popular classification of Latreille and Schœnherr, so far as respects this primary division.

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* In a paper on the systematic value of the Rhynchophora, read before the National Academy of Sciences, at Washington, Jan. 24, 1867, Dr. LeConte adduces this habit of the Curculionidæ of pushing their ova into the cavities prepared for them by means of the rostrum or beak, as an evidence of degradation or inferiority of type. "It was reserved," he says, "for the Rhynchophora to exhibit a degradation of type, by which a function, peculiarly appropriate to the posterior extremity of the body, is performed by the head: the elongated beak becoming in fact the ovipositor."

Dr. George H. Horn, in an article upon the Curculionidæ, contributed to the American Philosophical Society, Sept. 19, 1873, in describing the species of the genus Balaninus, states that the females have a slender ovipositor, which they are capable of extending to half the length of their bodies, and that he possesses a specimen with the ovipositor protruded, and an egg seized by its tip. From this he infers that the Balanini, and probably other Curculionidæ also, use their beaks only to make the perforation into which the egg is to be deposited, but that the act of inserting the egg is done in the ordinary way by the ovipositor.

The fact, however, that many, (if not all) of the Longirostres, or long-snouted Curculios, use their beaks to force their ova to the bottom of the cavities prepared for them, is too well attested to admit of question. Several species of Rhynchites and Anthonomus are described as thus ovipositing, in Kollar's Treatise, (page 238, et. seq.); and the common Plum-curculio, (*Conotrachelus nenuphar*), is known to practice the same method. (See Practical Entomologist, vol. 2, page 115.)

But the argument above stated to prove the relative inferiority of the Rhynchophora, appears to me more fanciful than real. The great majority of Coleoptera have neither beak nor ovipositor, and simpl deposit their eggs upon the surface of the substances upon which, or within which, their larvæ are to reside. The additional precautions taken by the Rhynchophora to ensure the preservation of their eggs and the welfare of their offspring, would seem to furnish a more certain proof of superiority of instinct, than of any systematic degradation.

Section 1. *Brevirostres.* Rostrum short and broad, never much longer than the head; scrobes extending to the end of the rostrum, and the antennæ inserted at or near their extremities. Anterior coxæ contiguous. Elytra covering the whole of the abdomen.

Section 2. *Longirostres.* Rostrum usually much longer than the head, narrow and cylindrical; scobes very rarely reaching the end of the rostrum, and the antennæ usually inserted at a greater or less distance from its extremity, generally near the middle, and sometimes at its base. Coxæ and elytra various.

The Longirostres, which are much the most numerous, are divided by Lacordaire, into two sub-sections accordingly as the anterior coxæ touch each other, or stand more or less apart. The former he names *Synmerides*, meaning *thighs contiguous;* and the latter *Apostasimerides*, (which we have contracted to *Apomerides*), meaning *thighs separate*.

The word *scrobe*, used in describing the Curculionidæ, is the name given to the channel on each side of the rostrum for the reception of the antennæ. The term *occular lobes* refers to the form of the anterior and lateral margins of the thorax, which, in this case, curve forwards so as to touch or partly cover the eyes. *Scape* is the same as *pedicel*, and is the name of the elongated first joint of the antennæ. The *rostral canal* is the name of the groove in the prosternum of some species for the reception of the rostrum when it is bent under the breast in repose.

It is necessary to bear in mind that as the Curculionidæ are, for the most part, small insects when compared with the Coleoptera in general, the terms large and small, when applied to particular groups or species, have a modified significance. A curculio half an inch or upwards in length, is comparatively *large;* one a quarter of an inch, is *medium;* and one an eighth of an inch or less, is *small* or *very small.*

The following tables exhibit the principal groups or sub families into which this extensive family has been divided:

Section 1. *Brevirostres.*

A. Antennæ straight; eyes round..............................ITHYCERIDES.
A A. Antennæ slightly elbowed; eyes oblong, narrowed inferiorly..CLEONIDES.
A A A. Antennæ strongly elbowed.
  B. Eyes large, depressed, transverse, pointed at the lower extremity. Prothorax with ocular lobes; scrobes directed inferiorly .... LEPTOPSIDES.
  B B. Eyes round or oval.
    D. Prothorax without ocular lobes; eyes generally moderate—sometimes round, sometimes oval.

E. Mentum large, concealing the maxillæ; sternum not hollowed in front.
  F. Scrobes linear directed beneath the rostrum; scape rarely extending beyond the posterior border of the eyes, often not reaching it: BRACHYDERIDES.
  F F. Scrobes often dilated, forming winglets (*pterygia*) on the sides of the end of the rostrum, never linear and directed beneath; scape extending beyond the eyes (except in Brachystylus,): OTIORHYNCHIDES.
E E. Mentum small, not concealing the maxillæ; sternum more or less hollowed out in front to receive the rostrum.
  G. Scrobes deep, linear, reaching the mouth.
    H. Scrobes reaching the eyes. Rather large insects, either glabrous or pubescent.................................MOLYTIDES.
    H H. Scrobes various in length; small insects clothed with hairs or fine scales................................HYPERIDES.
  G G. Scrobes short, curved, sub-basal..................ATERPIDES.
D D. Prothorax with ocular lobes; eyes generally large, oval and transversal.
  I. Tarsi hispid, not spongy beneath; third joint not dilated nor bilobed.................................BYRSOPSIDES.
  I I. Tarsi spongy; third joint bilobed.
    K. Rostrum widened and hollowed triangularly at the end; scrobes confluent on the under side of rostrum: PROMECOPIDES.
    K K. Rostrum more or less enlarged, but not notched at the end; scrobes shallow and incomplete posteriorly: CYLINDRORHINIDES.

Section 2. *Longirostres.*

First Sub-section—*Synmerides.* Anterior coxæ nearly or quite contiguous; never with a groove between them for the reception of the rostrum.

A. Antennæ elbowed, first joint much longer than the others.
  B. Body oblong, cylindrical, covered with a fine powder; tarsal claws soldered together at base...Lixides.
  B B. Body not cylindrical and pulverulent; ungues free.
    C. All the tibiæ terminated with a claw.
      D. Thorax longer than wide, swollen anteriorly; narrowed behind; eyes round..Otidocephalides.
      D D. Thorax narrowest in front; eyes oval or oblong.
        E. Body rough; eyes almost or quite contiguous above; abdominal sutures very deep.................................Prionomerides.
        E E. Body smooth, glabrous or pubescent.
        F. Body elongate, sides parallel, glabrous, punctured; usually black or bluish..Magdalinides.
        F F. Body oval; usually brownish and pubescent, and often variegated.
          G. Tibiæ slightly compressed and hollowed on the inner side; rather large insects; inhabit pine trees......................Hylobiides.
          G G. Tibiæ round; small insects; usually found on low plants: Erirhinides
    C C. Tibiæ unarmed or simply mucronate at the end.

H. Rostrum very long and slender; prosternum well advanced in front ....BALANINIDES.

H H. Rostrum not excessively long; prosternum very short in front of anterior coxæ.

I. Eyes rather small, round; hind thighs not thickened: ANTHONOMIDES.

I I. Eyes contiguous above; hind thighs enlarged for jumping: ORCHESTIDES.

A A. Antennæ straight, first joint not much longer than the following ones; anterior coxæ elongated.

K. Rostrum short or moderate, more or less widened at the end; tip of abdomen exposed....................ATTELABIDES.

K K. Rostrum long and slender; abdomen wholly covered by elytra; body pear-shaped ....APIONIDES.

Second Sub-section—*Apomerides.* Anterior coxæ more or less distant from each other, and frequently with a groove, or rostral canal in the prosternum, between them.

A. Capitulum of antennæ ordinary, with transverse incisions; tarsi spongy beneath; third joint bilobed.

B. Anterior coxæ exceptional, being nearly or quite contiguous; rostral canal very short, but distinct; thighs often with a tooth.....CONOTRACHELIDES.

B B. Anterior coxæ separate.

C. Antennæ elbowed.

D. Hind margin of the abdominal segments straight.

E. Rostral canal wanting; anterior coxæ large, sub-globular and wide apart, tip of abdomen largely exposed.....................LEMOSACIDES.

E E. Rostral canal distinct; anterior coxæ ordinary; tip of abdomen little or not exposed.

F. Rostrum thickened at the end (ex. Analcis); abdomen ordinary; eyes large, oval, not contiguous above...........CRYPTORHYNCHIDES.

F F. Rostrum slender; venter turned up behind; eyes contiguous: ZYGOPIDES.

D D. Hind margin of second and sometimes third and fourth abdominal segments arched or angulated.

G. Rostral canal short or wanting; scutellum indistinct or wanting; colors various ...........................CEUTORHYNCHIDES.

G G. Rostrum often thickened and compressed at base; rostral canal wanting; scutel distinct; color black or bronze. .BARIDIIDES.

C C. Antennæ straight, very short; first joint short and obconic; rostrum short.

H. Eyes on the front, sub-contiguous; hind legs very long; hind coxæ very wide apart.......................TACHYGONIDES.

H H. Eyes lateral; legs ordinary; tip of abdomen largely exposed: PTEROCOLIDES.

A A. Capitulum solid, globrous, with a spongy tip; tarsi entire, not, or but slightly, spongy beneath.

I. Eyes large; tip of abdomen exposed; size medium or large: CALANDRIDES.

I I. Eyes small or wanting; abdomen wholly covered by elytra; small, black or brown, usually glabrous......COSSONIDES.

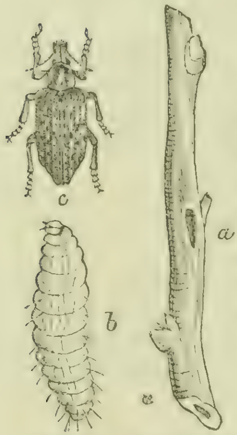
We will add a few additional notes upon those sub-families which are most common or most numerous in species, and which will therefore be most likely to occur to the student:

Section 1st. *Brevirostres.*

Sub-family ITHYCERIDES.

This sub-family has been formed to receive a single N. American species, the *Ithycerus noveboracensis*, or New York weevil, a comparatively large and rather common species which is sometimes considerably injurious to apple trees by devouring the buds and bark of young twigs. It differs from all other short-snouted weevils in not having the antennæ elbowed. The rostrum is robust, and the scrobes very short and oblique. It is a bulky insect five or six-tenths of an inch long, of a gray color, with a few small black spots on the wing-covers. The name is derived from the Greek *ιθυς* straight, and *χερας* antennæ.

[Fig. 61.]



ITHYCERUS NOVEBORACENSIS, Forster:—*a*, slit made in oak twig by female for depositing her eggs; *b*, larvæ; *c*, beetle—after Riley.

Sub-family CLEONIDES.

In these the antennæ are but slightly elbowed, thus forming a transitional group from the Ithycerides to those which follow. The rostrum is rather robust and angular or carinated above, and longer than the head; the scrobes are linear and deep, directed beneath, but not meeting behind. The thorax is almost always furnished with ocular lobes. The tibiæ terminate in a dagger-like spine. These are large species averaging about half an inch in length; oblong, cylindrical and pubescent. The larvæ of some are found in the stems of thistles. Six N. A. species have been described, all belonging to the genus *Cleonus* of Megerle.

Sub-family LEPTOPSIDES.

The most striking character of this group is the form of the eyes, which are large and placed transversly or crosswise of the head, and more or less narrowed and pointed at their lower extremity, whence, in common with some others, they have been denominated by Lacordaire *Oxyopthalmes*, meaning *pointed eyes.* We have two N. A. genera, *Panscopus*, Sch., and *Ophryastes*, Sch.; the former contains but one species, the *P. erinaceus*, Say, a sordid brown curculio, a little more than quarter of an inch in length, with a rough surface and clothed with short stiff hairs. We have taken them abundantly in Michigan, under the chips placed as traps for the Plum-curculio. Thirteen species of Ophryastes have been described, none of which have been found east of the Mississippi river. They are large species covered with cinereous scales. The eyes are partly covered by the prominent ocular lobes. The family name is derived from Leptops, (meaning *narrow eyed*) a genus peculiar to Australia.

Sub-family BRACHYDERIDES.

This sub-family comprises an extensive and considerably heterogeneous assemblage of insects, which, taken in connection with the Otiorhynchides which follow, constitute the greater part of the division called, by Lacordaire, *Cyclopthalmes*, meaning *round eyes*, and which are distinguished by the union of the three characters of short snouts, round eyes and the maxillæ covered by the mentum. The Brachyderides are for the most part comparatively large species, often clothed with fine scales; most of them are found upon the ground, but some upon herbaceous plants. The sub-family contains the following N. A. genera, with the number of described species in each: Epicærus 7, Pandeleteius 1, Polydrosus 2, Sitones 8, Tanymecus 5, Thalacites 1, Pachnæus 2, Parynotus 1, Lachnopus 1, Platyomus 1, Strophosomus 1.

Sub-family OTIORHYNCHIDES.

This word literally means *ear-snouted*, and is intended to express the most peculiar character of the sub-family, which consists in an ear-like expansion on each side of the end of the rostrum, but some species are included which have not this character. Another distinctive character is the length of the scape, or first joint of the antennæ, which, except in the genus Brachystylus, always extends backwards beyond the eyes. Many species are found under moss and grass. Such larvæ as are known feed upon the roots of plants. N. A. genera: Otiorhynchus 3 species, Agraphus 1, Tyloderes 1.

Sub-family CYLINDRORHINIDES.

Rostrum as long, at least, as the head, rather stout, and more or less enlarged at the end. Scape reaching the eyes. Eyes oblong and transversal. Thorax with ocular lobes, and imperfectly contiguous to the elytra. This sub-family contains the genus *Listroderes*, Sch., of which seventeen N. A. species have been described. This genus forms one of the transitional groups between the short-snouted and the long-snouted Curculionidæ, the rostrum being usually nearly twice as long as the head. They can be distinguished from most allied groups by the eyes being partly covered by the ocular lobes, a character possessed by very few N. A. Curculionidæ. The species vary from an eighth to a half of an inch in length.

Section 2d. *Longirostres.*

Sub-family LIXIDES.

With this sub-family commences the section of Longirostres, the snout being cylindrical and decidedly narrower and longer than the head, but their transitional position is shown by the antennæ being inserted not very far from the end of the rostrum. The Lixides are distinguished by their elongate, almost cylindrical bodies, which are covered with a fine dust, like the bloom on a fresh plum or grape. This bloom is sometimes bluish, sometimes orange, and is very easily rubbed off, so that perfect specimens are rarely obtained; and for this reason it is often difficult to identify the species. They are of rather large size for this family, the species usually ranging from a third to half an inch in length. Some of them inhabit water plants, and some foreign species breed in the stems of thistles.

We have two genera: *Lixus*, Fab., 13 species; and *Larinus*, Germar, 2 sp. In the latter genus the scrobes, or grooves on the side of the rostrum, usually meet behind on the under side.

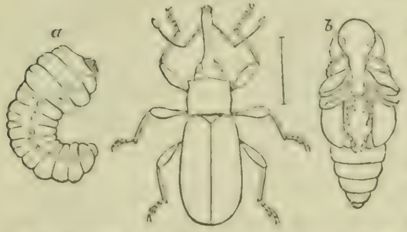
Sub-family OTIDOCEPHALIDES.

This name is derived from the Greek *otis*, a kind of *owl*, and *kephale*, the *head*; the swollen anterior part of these insects having some fancied resemblance to the head of an owl. The thorax is swollen before and narrowed behind, a character not found, we believe, in any other Curculionidæ, and which has caused them to be compared with ants. The antennæ are inserted rather near the end of the rostrum. The sternum is concave or hollowed in front.

The sub-family is composed of the single genus *Otidocephalus*, Chevrolat. The species are from an eighth to a quarter of an inch in length, and usually of a shining black color. They are exclusively American. Five species have been described which inhabit the United States.

Sub-family MAGDALINIDES.

[Fig. 62.]

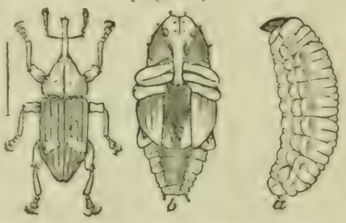


MAGDALINUS OLYRA:—*a*, larva; *b*, pupa—after Packard.

Rostrum rather long and cylindrical; scobes linear, commencing near the middle, and reaching the base. Eyes transverse, approximate above. Prosternum not excavated. Small species of an oblong parallel form, glabrous, usually black or blue, but sometimes reddish. Thorax deeply punctate. Elytra punctate and striate. The larvæ depredate upon the pine, boring into the pith of the smaller branches. A foreign species is said to have been reared from a larva found in burrows under the bark of willow trees. The *M. armicollis*, Say, inhabits the elm. Nearly all the species belong to the typical genus *Magdalis*, Germar, of which seven N. A. species have been described.

Sub-family HYLOBIIDES.

[Fig. 63.]



PISSODES STROBI:—*a*. larva; *b*. pupa—after Packard.

Rostrum twice as long as the head, cylindrical, sometimes moderately robust; scrobes deep, linear and oblique. Scape clavate, nearly or quite reaching the eyes. The anterior coxæ are somewhat separated. The tibiæ usually compressed, often curved, and terminated by a stout curved spine. Tarsal claws elongated. Size rather large. Body oblong and pubescent. The larvæ gnaw galaries under the bark of trees, chiefly the pines, often doing much injury. This habit is expressed by the family name, which means, *living in wood*.

The sub-family contains the following N. A. genera: *Hylobius*, Germar, 3 species. *Eudocimus*, Sch., 1. *Pissodes*, Germ., 5. *Heilipus*, Germ., 3. *Lepyrus*, Germ., 3.

Sub-family ERIRHINIDES.

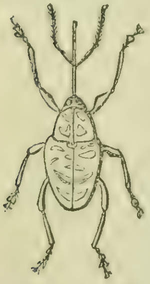
From the Greek *ριν*, *ρινος*, the *nose* or *snout*, with the intensifying prefix *ερι*. Rostrum long and slender. Scrobes commencing at a distance from the mouth and reaching the eyes. Antennæ long and slender. Scape sub-clavate. Tibiæ slender, not compressed, and usually with a spine or claw at the end. These are distinguished from the Hylobiides chiefly by the form of the tibiæ; but they embrace a number of groups, each of which has some remarkable peculiarity.

In the group Cryptoplides, containing the genera *Endalus*, *Brachybamus*, and *Smicronyx*, the fourth joint of the tarsi scarcely extends beyond the lobes of the third. In the group Hydronomides, represented in this country by the genus *Bagous*, Sch., the tarsi differ from the common type of the Curculionidæ in being slender, and not spongy beneath, and the third joint not bilobed; the fourth joint is elongated. The species of this group are found on aquatic plants, and their bodies are covered with minute scales which shed the water.

The species of this sub-family are all small, ranging from a quarter to a tenth of an inch in length. The described N. A. species are as follows: *Erirhinus*, Sch., 10 species. *Endalus*, DeCasteln, 4. *Brachybamus*, Sch., 2. *Bagous*, Sch., 2.

Sub-family BALANINIDES.

[Fig. 64.]



Balaninus—after Rye.

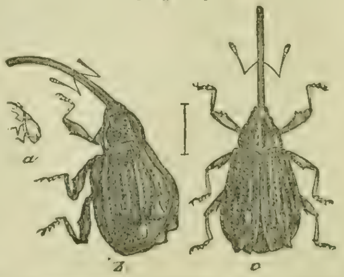
From *Βαλανος*, a *nut* or *acorn*, in which the larvæ reside. Head globular. Rostrum very long, slender and filiform. Scrobes linear, commencing a little beyond the middle of rostrum and reaching the base. Antennæ slender. Eyes large. End of abdomen slightly exposed. Distinguished at once by their long, slender rostrum, almost as fine and glossy as a hair. The larvæ inhabit nuts and fruit, and sometimes the galls made by other insects. The female pierces a hole with her rostrum for the deposition of her eggs. They enter the ground to transform. The species are, for the most part, of medium size, and of a mottled brownish color. The sub family is composed of the genus *Balaninus*, Germar, of which 8 N. A. species have been described.

Sub-family ANTHONOMIDES.

Head somewhat conical. Rostrum slender and projecting forwards, and varying in length in different species, and sometimes in the two sexes of the same. Scrobes linear, commencing near the middle of the rostrum and reaching the base. Eyes approximate above. End of abdomen little or not at all exposed. These are small, somewhat pear-shaped curculio, without any very strongly marked characters.

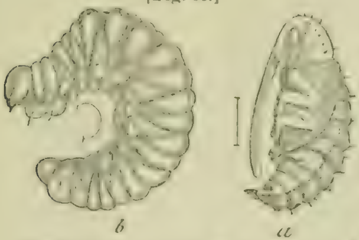
They are a very important sub-family, in an economic point of view, many of them

[Fig. 65.]



Anthonomus, 4-gibbus, Say:—Apple Curculio: *a*, natural size: *b*, *c*, side and back view, enlarged—after Riley.

[Fig. 66.]



ANTHONOMUS, 4-GIBBUS, Say:—*a*, pupa; *b*, larva, enlarged—after Riley.

being injurious to fruits. Kollar has described the habits of two European species, the Apple-weevil, *A. pomorum*, Fab., and the Pear-weevil, *A. pyri*, Kollar, which deposit their eggs in the fruit buds of these trees. The Apple curculio, *A. quadrigibbus*, of Say, (Fig. 65) and the Plum-gouger, *A. prunicida*, of Walsh, are well known American species. Both of these deposit their eggs in the fruit. The larvæ of these insects do not go into the ground to pupate, like the common Plum-curculio and many others, but go through all their stages in the buds or the fruit which they infest. All the N. A. insects of this sub-family belong to the genus *Anthonomus*, Germ., of which 15 species have been described.

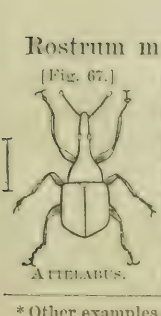
Sub-family ORCHESTIDES.

From *ορχηστης*, a *dancer* or *jumper*. These resemble the Anthonomides in most of their characters, but differ in having the hind thighs much swollen, with a corresponding muscular development which gives to them the power of jumping. The prosternum is very short, permitting the rostrum to be bent beneath in repose. Eyes large, oval, and nearly meeting above. This little group is very remarkable for the structure and habits of the larvæ. They are somewhat flattened, and pointed behind, and furnished with six feet, a remarkable departure from the apodal character of other curculionide larvæ. But the most anomalous circumstance is that these larvæ are leaf-miners, a habit of which there are but few examples* in the order of Coleoptera, and exhibiting a curious analogy to the larvæ of many of the Micro-Lepidoptera; and this analogy is carried out by the larvæ when fully grown and about to change to pupæ, enclosing themselves in silken cocoons. Two N. A. species have been described by Mr. Say belonging to the genus *Orchestes*, Illiger. They are only about a tenth of an inch in length.

Sub-family ATTELABIDES.

Rostrum more or less robust and enlarged at the extremity; scrobes superior, large and pit-shaped. Antennæ straight, or not elbowed, the first joint being but little longer than the following ones. This character readily distinguishes this and the following sub family from the great majority of Curculionidæ. They are divided into two groups: the Attelabides proper, with short, thick bodies, tibiæ unguiculate at the end, and claws soldered together; and

[Fig. 67.]



ATTELABUS.

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* Other examples are found in Hispa and Haltica.

the Rhynchitides, more elongate and depressed, with unarmed tibiæ, and free, usually bifid claws.

The females roll up leaves and deposit their eggs singly in the cavities thus made. The larva inhabits this cavity, and, when fully grown, leaves it and goes into the ground to transform. N. A. genera: *Attelabus*, Linn., 5 species; *Rhynchites*, Herbst, 8; *Eugnamptus*, Sch., 2.

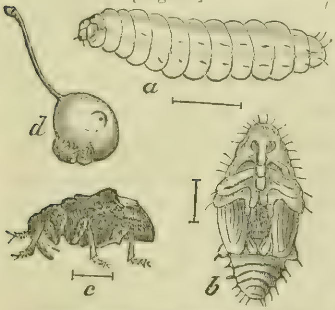
Sub-family APIONIDES.

From *απιον*, a *pear*. Rostrum long, curved, cylindric or subulate; scrobes foreiform or pit-shaped. Antennæ not elbowed. Size small or very small; body pear-shaped, usually glabrous, and without wings. Habits of the larvæ various. Some live in seeds, especially those of the leguminosæ. Some form galls on the stems and leaves of plants. Some bore into the pith of certain plants and form a kind of cocoon of the detritus or gnawed particles. Finally, some inhabit knots which they form upon the roots of plants. Twenty-one N. A. species of the genus *Apion*, Herbst, have been described.

Sub-family CONOTRACHELIDES.

Meaning having a *conical thorax*. With this sub-family we pass to the sub-section of Apomerides (Apostasimerides, Lacordaire,) a term derived from the Greek *apo—apart*, and *meros*—the *thigh*, in allusion to the greater or less separation from each other of the anterior coxæ; whereas in all the preceding sub-families these parts stand nearly or quite in contact. The present is a transitional group in this respect, the anterior coxæ being but slightly separated. The rostrum is various as to length; the scrobes turn rapidly beneath, and are confluent behind, being imperfectly visible on the sides. The ocular lobes are advanced so as to nearly or quite cover the eyes when the rostrum is bent down. Thighs usually with a tooth on the under side. Size small, or medium; colors generally obscure. The sub-family is exclusively American. Fourteen N. A. species have been described. The notorious Plum-curculio, *Conotrachelus nonuphar*, Herbst (Fig. 68), may be taken as an example of the genus and its larvæ.

[Fig. 68.]

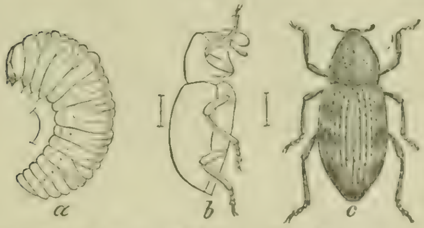


Conotrachelus nenuphar, Herbst:—Plum and peach curculio—*a*, larva; *b*, pupa; *c*, beetle; *d*, a plum, showing the crescent slit made by the female after depositing her egg—after Riley.

Sub-family CRYPTORHYNCHIDES.

Rostrum varying in length, usually somewhat enlarged both at base and tip (attenuated in Analcis.) Scrobes oblique. Antennæ far from base of rostrum; scope at most reaching the eyes. Rostral canal extending onto the mesosternum. Eyes large, pointed inferiorly. Ocular lobes more or less prominent. Thighs sometimes toothed beneath. Tibiæ spined at the end. In Cryptorhynchus proper the tibiæ have a band of rigid hairs near the extremity, usually bright yellow, but sometimes black. These are small species found on plants. The body is of various form, and is usually clothed with scales. The family name signifies having a *concealed snout*, and has reference to the rostrum being bent under the breast, and lying in the groove called the rostral canal. N.A. species: *Cryptorhynchus*, Illiger, 11; *Acalles*, Sch., 3; *Pseudomus*, Sch., 1; *Analcis*, Sch., 4.

[Fig. 69.]



ANALCIS FRAGARIÆ, Riley:—Strawberry crown-borer—*a*, larva; *b*, outline side view; *c*, back view of beetle—after Riley.

Sub-family CEUTORHYNCHIDES.

Rostrum cylindric, not thickened at base; scrobes lying along the inferior edge of the rostrum, rarely very oblique. The rostral canal varies in the different groups, as shown below. Scutellum wanting or indistinct. The three intermediate segments of the abdomen strongly arched. Tibiæ unarmed. The name means the same as that of the preceding sub-family, and implies that the rostrum is more or less concealed, but the prosternal groove is here usually less distinct, and sometimes wanting. They are chiefly distinguished from the Cryptorhynchides by the absence of scutellum, and of points at the end of the tibia, and by the abdominal segments strongly arched behind. They are small insects, found mostly on low herbage in wet places. The habits of the larvæ are various, some inhabiting seeds, and others the stems or roots of plants. The Mononychi transform on the plant, whilst the Ceutorynchi go into the ground and enclose themselves in cocoons. The species are numerous, and are divided by Lacordaire into three groups, as follows:

A. Eyes covered, at least partly, by the thorax.
  B. Rostral canal extending onto the mesosternum, and sometimes the metasternum...CŒLIODIDES.
  B B. Rostral canal not extending beyond the anterior coxæ...............CEUTORHYNCHIDES proper.
A A. Eyes exposed. Rostral canal indistinct or wanting.....................................PHYTOBIIDES.

In the first group we have one species of the genus *Mononychus*, Germar, the *M. vulpeculus*, Fab., found on the flowers of the wild Iris, and five species of *Cœliodes*, Sch. In the second group, *Ceutorhynchus*, Germar, 5 species. In the third group, *Phytobius*, Sch., 3 species; *Cœlogaster*, Sch., 1 species; and *Rhinoncus*, Sch., 1 species.

Sub-family BARIDIIDES.

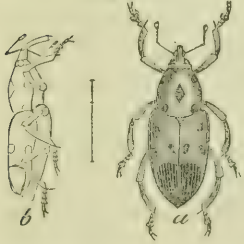
Rostrum various, often compressed and thickened at base; scrobes commencing near the middle, and turning rapidly beneath. Scutellum distinct. Rostral canal wanting; but in *Centrinus* there is an excavation between the coxæ, which, in the male, often has a spine on each side. Intermediate segments of the abdomen usually arched or angulated behind. The eyes are finely granulated, and partly covered by the thorax. The tibæ are usually mucronate or pointed at the extremity. Size medium or small; of elliptical or rhomboidal form; usually black or brown, sometimes with reddish spots. The larvæ live in the stems or roots of plants, and are sometimes very injurious to cultivated crops. They undergo their transformations in the detritus which they have made, and with which they construct a kind of cocoon.

N. A. genera: *Centrinus*, Sch., (body short and rhomboidal), 11 species; *Baridius*, Sch., (body oblong or oval), 30 species; *Madarus*, Sch., (body oblong rhomboidal), 2 species.

Sub-family CALANDRIDES.

Rostrum more or less elongated; scrobes short. Antennæ basal; scape usually reaching far onto the thorax; knob without joints, horny and shining at base, with a spongy extremity. Eyes finely granulated, large, depressed and approximate below. Tip of abdomen exposed. Tarsi not spongy beneath, 3d joint not bilobed. Size sometimes small, but usually medium or large; some tropical species very large. Color black or reddish. The larvæ of the larger species inhabit the stems of plants, whilst the smaller are usually destructive to grain and seeds. When about to transform they construct a coarse kind of cocoon from the materials in which they live.

[Fig. 70.]



SPHENOPHORUS 13-PUNCTATUS, Illiger:—*a*, variety *pulchellus*, Sch., in which the two spots at the end of each elytron are enlarged and coalesce so as to cover the whole tip; *b*, side view—after Riley.

We have three genera: *Rhyncophorus*, Herbst, of large size, and distinguished for the excessive development of the side pieces of the metasternum, 2 species; *Sphenophorus*, Sch., of medium or rather large size, usually between a quarter and a half of an inch in length, 42 species; and *Calandra*, Clairville, (*Sitophilus*, Sch.,) less than a quarter of an inch in length, 3 species.

Sub-family COSSONIDES.

Rostrum usually rather long; scrobes short, commencing at or beyond the middle. Antennæ short. Eyes small or wanting. Tip of abdomen not exposed. Tarsi short, filiform, not spongy beneath, 3d joint rarely bilobed. Small insects, of an oblong linear form, with puncto-striate elytra, and usually of a shining black or brown color. They form a connecting link between the Curculionidæ and the Scolytidæ, being mostly sub-cortical and lignivorous in their habits. The five following genera are represented in the N. A. fauna: *Cossonus*, Clair., 6 species; *Rhyncolus*, Creutz, 7 species; *Dryopthorus*, Schupp, 1 species; *Lymantis*, Gyll., 1 species, and *Phlœophagus*, Sch., 1 species.

TRIBE XVII.

SHORT-HORNED WOOD-BORERS.

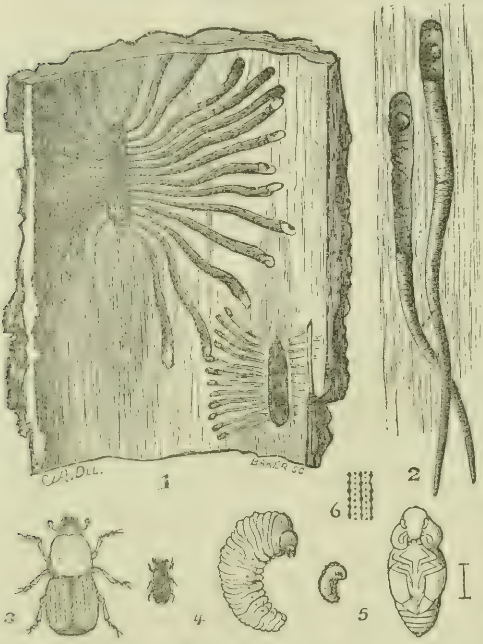
Lignivora brevicornia. XYLOPHAGA, Latreille.

This tribe is composed of small beetles of a short and nearly cylindrical form, and of a brown or blackish color. The antennæ are very short, often not much longer than the head, slightly elbowed, and always terminating in a knob. In many species the abdomen is truncated, or cut off obliquely behind, and terminated with a coronet of short spines. The larvæ are scarcely distinguishable from those of the Curculionidæ, being soft, white, footless grubs, usually lying in a curved position. They differ, however, from the great majority of the larvæ of the Curculios in their wood-boring habits. Indeed, they are pre-eminently the *wood-borers* of the whole order of Coleoptera, no other tribe vying with them in this respect except the Long-horned borers, to be hereafter described. Though small in size, rarely exceeding a quarter of an inch in length, and often less than half that length, they are tolerably numerous in species, and often excessively abundant in individuals. They inhabit various kinds of trees, but mostly the pines, which they have been known to damage considerably in this country, whilst in some parts of Europe they have destroyed whole forests by their enormous multiplication. They are comprised in the single family of Scolytidæ.

Family LIX. SCOLYTIDÆ.

Named from the genus *Scolytus*, Geoff., derived from the Greek *skolupto*—to *denude* or *lacerate*.

[Fig. 71.]



Scolytus 4-spinosus, Say; S. caryæ, Riley:—1, shows the burrows of the larvæ between the bark and the wood, growing wider as they diverge from the line where the eggs are deposited; 2, another view of the same, showing the hole made by the exit of the beetle; 3, beetle, both magnified and natural size; 4, larva, the same; 5, pupa magnified—after Riley.

This family is co-extensive with the tribe of short-horned borers which we have just described. They are usually regarded as closely allied to the Curculionidæ; but, as we have stated above, they differ greatly from the latter in their food-habits, and also in the details of their organization. In addition to the characters given above, we may add that they differ from the great majority of the tetramerous beetles, including the Curculionidæ, in having simple tarsi, not spongy beneath, and with the last joint but one not at all, or but very slightly, bilobed. In Dr. LeConte's sketch of this family in the 2d Vol. of Trans. of Am. Ent. Society, one hundred and three N. A. species are enumerated, distributed in eighteen genera or sub-genera. But all the more common species may be included in the six following genera:

A. Head free; 1st joint of the tarsi as long as the others united..........................Platypus.
A A. Head deeply inserted in thorax; first joint of tarsi much shorter than the others united.
  B. Abdomen of the usual form.
    C. Head not globular, visible from above; 3d joint of the tarsi slightly bilobed.
      D. Knob of the antennæ sub-globular.
        E. Six joints in the antennæ before the knob....................................Hylurgus.
        E E. Seven joints in the antennæ before the knob...............................Hylastes.
      D D. Knob of the antennæ as long as the preceding joints united....................Hylesinus.
    C C. Head globular, invisible from above; 3d joint of tarsi not bilobed....................Tomicus.
  B B. Venter turned up behind..Scolytus.

The *Platypus compositus*, Say, may be taken as a type of this genus in this country. It is one-fifth of an inch long, of a reddish-brown color, and each elytron has a three-toothed elongation at its extremity. Dr. Chapuis, in his monograph of this genus, describes nine N. American species, none of which are very common.

Hylurgus, Latreille, contains a number of well known species, the largest and most common of which is the *H. terebrans*, Oliv., of a reddish-brown color, with the thorax deeply punctured, and quarter of an inch in length. This insect is often seriously injurious to pine trees. An account of its habits is given in Dr. Harris' Treatise. A much smaller species, the *H. dentatus*, Say, often bores innumerables holes in the red cedar.

We have ten described species of *Hylesinus*, Fab. Whilst the species of Hylurgus and Tomicus are found in evergreens, and especially in the different kinds of pine, the species of Hylesinus and Scolytus inhabit mostly, if not exclusively, the hard-wooded deciduous trees. The most common species is the *H. aculeatus*, Say. The specific name means *prickly*, and has reference to minute elevated points on the elytra. It is a tenth of an inch in length, or a little more, of a blackish-brown ground color, but largely varied with ash color, produced by microscopically minute scales. The top of the thorax is bare, leaving a large elliptical blackish spot. The antennæ are reddish. This little insect is often seen in the first warm days of spring sunning itself upon stumps or fences which run through timbered land. I have found it abundantly in wood which appeared to be that of some species of poplar.

In *Tomicus*, Latr., the tip of the abdomen is cut off obliquely and surrounded with a number of short spines. They are all of a reddish or chestnut color. Three of the species are frequently met with in pine forests, all of which were originally described and named by Mr. Say. They are the *T. excsus*, upwards of two-tenths of an inch in length, with six or eight points at the tip of each elytron; the *T. pini*, three-twentieths of an inch long, the tip of each elytron about four-toothed; and the *T. xylographus*, but little more than a tenth of an inch long, the elytra but slightly truncated, puncto-striate, with minute points on the posterior declivity, between the punctures.

Scolytus, Geoffroy, is distinguished by the singular formation of the abdomen, which is abruptly turned upwards on the under or ventral side, beyond the first segment. The head is usually flattened, and either striated or roughly punctured on top, and surrounded with a coronet of incurved hairs. They inhabit, as we have above stated, the hard-wooded trees. European species live in the oak, the elm, the ash, and the plum. The different kinds of hickory, including the shell-bark, the bitter-nut, and the pecan, are extensively damaged by the *Scolytus 4-spinosus*, Say, so-called on account of four short spines at the tip of the abdomen of the males. The turned up portion of the venter is moreover deeply concave in this sex, and divided down the middle by a carina, or ridge. It is nearly two-tenths of an inch in length, sometimes wholly black, but the elytra are often reddish-brown. The females are about a quarter part smaller, and the venter is but slightly concave, and without either spines or carina. In many groves of timber in Northern Illinois, the bitter-nut hickories have been completely destroyed by the larvæ of these little beetles. They work between the bark and the wood, cutting divergent furrows, as shown in the accompanying figure, and finally emerging, in the beetle-form, through round holes about large enough to admit a common knitting needle, and giving the tree the appearance, as Mr. Riley aptly remarks, of having been peppered with fine shot.*

TRIBE XVIII.

LONG-HORNED WOOD-BORERS.

Lignivora longicornia. EUCERATA, Westwood.

This large and conspicuous tribe of beetles is usually designated by the Latin word Longicornes, meaning *long horns*, in reference to their most striking character, namely, the great length of their antennæ, which, with a very few exceptions, are considerably longer than the head and thorax combined, and frequently longer than the whole body. They are sometimes strictly filiform, but usually setaceous, or tapering. Notwithstanding their great length, they very rarely have more than the normal number of joints, which, in the Coleopterous order of insects, is eleven. The genus Prionus, however, furnishes a remarkable exception in this respect, some of the species having as many as thirty joints in their antennæ. The tarsi are always four jointed, spongy beneath, and the third joint strongly bilobed, characters which readily distinguish them from the predaceous ground-beetles which also have the antennæ slender and considerably elongated.

A few of them have the wing-cases either much shorter, or much narrower than the abdomen, but in these instances, the wings are not folded up under them, as in the short-winged Staphylinidæ, but lie extended and exposed upon the abdomen. They are strong flyers, but do not readily take to flight, and are, therefore, easily captured, though they run with considerable rapidity, their legs being in harmony with the general elongation of their bodies and their antennæ. The thighs are very commonly clavate or enlarged at the end, giving room for an unusual development of the muscles of locomotion.

Many of these beetles, when captured, make a squeaking sound, called *stridulation*, by rapidly moving the prothorax upon the mesothorax. This faculty seems to be possessed by all of the sub-family of Lamiides, and by many of the Cerambycides, but to be absent in the Prionides.

Many of these insects are known to be nocturnal in their habits, and are sometimes seen flying about our lamps in the evening; but others, especially the Lepturides, are found upon flowers in the day time, and in the full light of the sun.

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* This insect has been described by Mr. Riley under the specific name *caryæ*; but I can find no sufficient grounds for regarding it as distinct from the 4-*spinosus*, of Say. The only positive difference stated is the absence of denticulations at the tip of the elytra, and these, though very minute, are distinct in the specimens which I have examined, of both sexes. The absence of certain details in Mr. Say's description can scarcely be adduced in proof of difference of species, since it was evidently Mr. Say's rule to practice the greatest brevity in his descriptions, consistent with what he deemed a sufficient identification of the species.

The larvæ are oblong, straight, moderately firm, sordid or yellowish-white grubs, chiefly distinguished by the depth of the incisions between the segments of the body, giving to them a strongly crenulated or wrinkled appearance. They are usually a little tapering from before backward, the first or prothoracic segment being larger than the others, but never excessively developed as in some of the wood-boring larvæ of the Buprestidæ.

The head is small and more or less sunken in the prothorax, but the larvæ of the Lepturides are exceptional in this respect, their heads being large and flattened and as broad as the pro-thorax.

The majority have six very small feet, which, in some, are scarcely more than rudimental, and the larvæ of the sub-family of Lamiides are distinguished from nearly all the others by being wholly footless—the place of feet being supplied by little callosities.

These larvæ, together with those of the short-horned tribe last described, constitute pre-eminently the wood-borers of the Coleopterous order. Though vastly surpassing the former in size and in the number of species, they would seem to be much inferior to them in the number of individuals, and, therefore, though a few of them have been very injurious to cultivated or ornamental trees, they have never been known to produce such extensive destruction of timber as has been effected by the larvæ of the diminutive but prolific Scolytidæ. A remarkable exception, however, to this statement occurred a number of years ago, in the almost total destruction of the locust tree *(Robinia pseudacacia)* throughout all the Northern States, by the larvæ of the Locust-borer, *Clytus robiniæ*, of Forster. This destruction did not occur in all places at the same time, but was extended mostly over the ten years between 1855 and 1865.

Upwards of 8000 species of longicorn beetles are known to exist in European cabinets. The Smithsonian catalogue of the year 1853 contains the names of 431 N. American species. In Dr. LeConte's New Species of N. A. Coleoptera, published in 1873, eighty-nine additional species are described, and in the intervening twenty years a considerable number of N. A. species had been described by Dr. LeConte and others, both in this country and in Europe.

Some of the characters in the following tables may require explanation. It will be seen that some of the largest Lamiides are distinguished by a cicatrix or scar at the end of the first joint of the antennæ. In these species the pedicel, or stout basal joint, appears as if cut off obliquely at the end, and this sloping part is enclosed by a little ridge or carina, and its surface differs from that of the surrounding parts by being covered with little elevated points or granulations. This is the part to which the term cicatrix is applied. Another character, valuable for its permanency, is the openness, or the closure, of the middle cotyloid cavity. The cotyloid cavity is the hollow in which the coxa is situated.

In some of the longicornes the posterior angle of the mesosternum is prolonged backwards till it nearly touches the anterior angle of the metasternum, and thus closes the cotyloid cavity on its outer side. In this case the epimeron of the mesothorax is usually narrow, and does not reach the cotyloid cavity. In others, the posterior angle of the mesosternum is but slightly prolonged backwards, leaving the cotyloid cavity open on the outer side. In this case the epimeron of the mesothorax is larger and extends inwards, so that its inner extremity, which is often somewhat widened, fills the gap between the angles of the meso- and metasterna. This description will be better understood by referring to the figure of Harpalus, on page 27.

Family LX. CERAMBYCIDÆ.

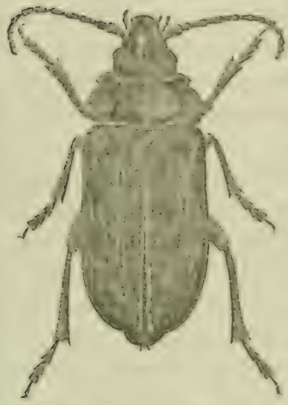
The long-horned wood-borers constitute one large natural family of beetles, named after the genus Cerambyx, an ancient Greek name for some kind of long-horned beetle, and applied by Linnæus to the insects of this family.

They are divisible into four sub-families, which may be distinguished as follows:

A. Head horizontal or inclined; last joint of palpi not long and pointed; anterior tibæ without furrow. Larvæ six footed.
  B. Head inserted in the thorax; eyes deeply notched or horse-shoe shaped; anterior coxæ not prominent. Larvæ with the head narrower than the body, and retractile.
    C. Thorax somewhat square-shaped, with a sharp lateral margin, which is usually from one to three-toothed; anterior coxæ strongly transversal. Body generally large and depressed; colors black or brown.........PRIONIDES.
    C C. Thorax rounded at the sides and without salient margin, sometimes with one spine or tubercle on each side. Size various; colors often bright and diversified.......................................CERAMBYCIDES.
  B B. Head attached to the thorax by a neck; eyes nearly or quite round; anterior coxæ angular and prominent; elytra generally narrowed behind. Larvæ with the head as wide as the body..........................LEPTURIDES.
A A. Head vertical; last joint of palpi cylindrical and pointed; anterior tibiæ usually with a furrow on the inner side. Larvæ footless.................LAMIIDES.

Sub-family PRIONIDES.

[Fig. 72.]

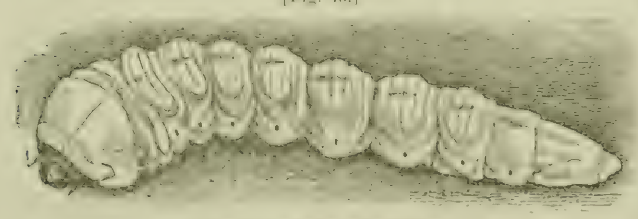


Prionus laticollis, Drury: female—after Riley.

The Prionides are generally large, slow-moving insects, flying only in the evening, and usually of uniform black or brown colors. They are distingushed from the other Longicornes chiefly by their sub-quadrate thorax, the sides of which form a sharp margin, which is usually divided into two or three teeth. The thighs are never clavate or suddenly enlarged at the end, as they are in many of the species of the other sub-families. The eyes are usually coarsely granulated, and the middle cotyloid cavities are widely open on the outer side. Some of the tropical species are of gigantic size, being five or six inches in length. The larvæ are broad and somewhat flattened, and have six very small but distinct feet. They inhabit the trunks and roots of trees.

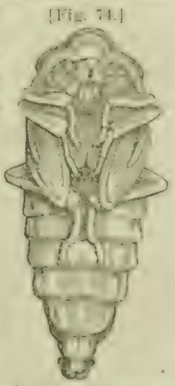
The sub-family is named after the genus Prionus, of Geoffroy, a term derived from a Greek word meaning *a saw*, and applied to these insects on account of the long saw-toothed antennæ of many of the species, especially of the males.

[Fig. 73.]



Larva of PRIONUS—after Riley.

[Fig. 74.]



Pupa of PRIONUS—after Riley.

The following are the principal N. American genera:

A. Antennæ not longer than the thorax; thoracic margin without teeth; tarsi simple... PARANDRA.
A A. Antennæ much longer than the thorax; tarsi spongy beneath, with the third joint bilobed.
  B. Eyes coarsely granulated; colors uniform.
    C. Thoracic margin prominent; side pieces of the metasternum parallel.
      D. Eyes not closely approximate; antennal joints imbricate; teeth of the thoracic margin short and flattened. Body robust .... PRIONUS.
      D D. Eyes very large, approximate above and below; thoracic teeth spine-shaped. Body elongate.
        E. Thorax much narrowed behind; margin three spined, the anterior spine shortest. 3d joint of the antennæ as long as the 4th and 5th united........................DEROBRACHUS.
        E E. Thorax nearly square; margin 3-spined, the hindermost spine shortest; 3d joint of antennæ but little longer than the 4th..ORTHOSOMA.
      D D D. Eyes very wide apart, but slightly notched; size very large; thoracic margin usually many toothed.
        F. First joint of antennæ much shorter than the third..............................ERGATES.

F F. First joint of antennæ at least as long as the third........................MALLODON.
C C. Thoracic margin almost wanting, with a short spine; side pieces triangular; head vertical..TRAGOSOMA.
B B. Eyes finely granulated; colors variegated; thorax rough, without lateral spine SPHENOSTETHUS.

Parandra, Latr., contains two species, one of which, the *P. brunnea*, Fab., is common. It is about seven-tenths of an inch long, and of a glossy mahogany-brown color. The other species, *P. polita*, Say, is much more rare. It closely resembles the other, but can be distinguished by its head being as wide as the thorax.

Prionus, Geoff., contains many species. The two most common are the *P. imbricornis* of Linnæus, less than an inch long, of a mahogany-brown color, with long imbricated antennæ, the joints lapping one upon another; and the *P. brevicornis*, or short-horned Prionus, of Fabricius; the antennæ of the female are scarcely a third as long as the body, but those of the male are much longer. This species is black, the male an inch and a quarter, and the female an inch and a half or more in length.

Derobrachus, Serv., contains one large brownish-yellow species found in the Middle and Southern States.

Orthosoma, Serv., contains one common species, the *O. cylindricum*, Fab., a long, narrow, brown insect, an inch and a quarter in length.

Ergates, Serv., has but one species, from California, originally described by Dr. LeConte under the name of *Trichocnemis spiculatus*.

Mallodon, Serv., contains several species, none of which are common.

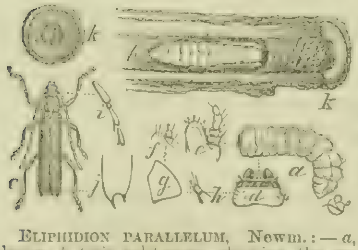
Tragosoma, Serv., contains but one species, the *T. Harrisii*, Lec.

Sphenostethus, Hald., contains but one species, the *S. serripennis*, Haldeman, but previously described by Buquet under the name of *Solenoptera Taslei*. It is of medium size, of a blackish-brown color, and inhabits the Middle and Southern States, but is nowhere common.

Sub-family CERAMBYCIDES.

The Cerambycides are much more numerous and diversified than the Prionides, and are often ornamented with bright and variegated colors. They differ from the Prionides chiefly in having the sides of the thorax rounded, without a salient margin, but sometimes furnished with a single spine or tubercle on each side, and from the Lamiides in having the head sometimes horizontal, but usually more or less inclined, whereas in the Lamiides it is verticle.

[Fig. 75.]



ELIPHIDION PARALLELUM, Newm.:—*a*, larva; *b*, twig split open, showing the enclosed pupa; *k*, the severed end of the twig; *c*, beetle; *i*, basal joints of the antennæ, showing the characteristic spines at the tip of the 3d and 4th joints; *j*, tip of elytron; *d*, *e*, *f*, *g*, *h*, head, maxilla, labium, mandible, and antenna of larva—after Riley.

It must be remarked however that the face may assume a vertical position in the Cerambycides, when the head is bent strongly downwards, but the transition from the occiput to the face is here usually more gradual and rounded, and in the Lamiides sharper or more abrupt. The face is also rather convex in the Cerambycides, and flat in the Lamiides. This distinction, however, is sometimes unreliable, and the more definite characters stated in the table of sub-families, must be resorted to in cases of doubt. But the minor groups can often be distinguished by their style of coloration, as hereafter specified.

The Cerambycides are often seen resting upon the trunks of trees in crevices of which the females lay their eggs. Some of the smaller species are found upon flowers. Many of them possess the stridulating power described in the general remarks upon this family. The larvæ resemble those of the Prionides in having six very small legs, but they are more cylindrical in their form, and the incisions between the segments are more deeply impressed.

The sub-family of Cerambycides is divided by Lacordaire into two groups, which are primarily distinguished by the difference in the facets or granulations of the eyes. In the first group the granulations are comparatively coarse and the lines between the facets are deeply impressed. In the second group the granulations are much finer, and in many genera the surface of the eyes, unless strongly magnified, appears to be almost plane. But this distinction is only comparative, and can only be appreciated by an actual examination of some of the species in the two divisions.

In the following table we have first separated the group of Asemini, upon the more definite character of the form of the eyes, and then divided the remainder in accordance with the difference in the granulations.

The following is a table of the groups of Cerambycides:

A. Eyes oval, almost entire, or but little hollowed on the inner side (except Tetropium); second joint of antennæ at least half as long as the third; form somewhat depressed; colors obscure: ASEMINI.
A A. Eyes with a deep notch or sinus; second joint of antennæ not half as long as the third.
  B. Eyes coarsely granulated. Form moderately convex; antennæ usually as long at least as the body, often much longer in the males; thighs usually slender; colors gray or brown. CERAMBYCINI.
  B B. Eyes finely granulated.
    C. Form more or less depressed; thighs usually strongly clubbed; colors various.....CALLIDIINI.
    C C. Form convex; thighs usually slender or moderately and gradually thickened.
      D. Scutellum rounded; size various; colors usually black or brown with transverse yellow or whitish bands .... CLYTINI.
      D D. Scutellum triangular and pointed; size large or medium; colors usually black and red: STENASPINI.

The group of ASEMINI contains two principal genera, *Asemum*, Esch., (from the Greek *asemos—obscure*) containing six species of a size a little above medium, with small, hairy, and finely granulated eyes, and *Criocephalus*, Muls., (from *krios—a ram*; and *kephale*—the *head*) containing nine species of large size, most of them being about an inch in length, with large and less finely granulated eyes, and having from two to four large shallow depressions on the disk of the thorax.

The CERAMBYCINI comprise many genera and species, but the three principal genera east of the Rocky Mountains are *Chion*, Newman, and *Eburia* and *Elaphidion*, Serville. *Chion* contains only the *cinctus*, Drury, and the *garganicus*, Fab., which are now regarded as one species. It is nearly an inch long, of a grayish-brown color, with an irregular oblique yellow band across each elytron, and a sharp spine at the side of the thorax. Its larva inhabits the hickory. The name *Eburia* is derived from the Latin *ebur—ivory*, in allusion to the ivory-like callosities on the elytra. We have ten species, the most common of which is the *E. quadrigeminata*, of Say, an elegant fawn-colored beetle more than three-quarters of an inch in length, with two double ivory-like spots on each elytron. Its larva lives in the honey-locust (*Gleditschia triacanthos*, Linn). *Elaphidion*, (from *elaphus—a stag*, on account of its long horns or antennæ) contains thirty-five plain brownish-gray species, which have been distributed in a number of sub-genera. The larvæ are the well known twig-pruners of the oak, the maple and other trees. The genus is distinguished by having several of the basal joints of the antennæ prolonged into spines at the tip.

The CALLIDIINI are also considerably numerous in species, most of which may be included in the genus *Callidium*, Fab., a name derived from a Greek word meaning beautiful, many of the species being prettily colored. The genus *Hylotrupes*, Serv., meaning a *wood borer*, is distinguished form Callidium by having the antennæ less than half as long as the body, and by having the thorax densely clothed with short whitish hairs. Its type is the *H. bajulus*, Linn., a dull blackish beetle about two-thirds of an inch in length, which has been imported into this country from Europe. Its larvæ are sometimes seriously injurious to fir, spruce and hemlock lumber, and they have been known to gnaw through sheets of lead when these come in their way. Two beautiful species, one red and the other purple, and both with ivory-like stripes on the elytra, have been set apart in the genus *Physocnemum*, of Haldeman, (*Dularias*, Thomson). *Callidium* proper, (including *Phymatodes*) contains twenty N. A. species.

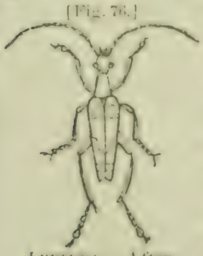
The CLYTINI constitute a very numerous group which has been divided into many genera, but most of which might be included in the genus *Clytus*. This name, usually attributed to Fabricius, is said by M. Mulsant to have been originated by Laichtining, in a work upon Tyrolese insects. It is derived from the Greek *klutos—sonorous*, or *noisy*—having reference to the squeaking noise made by these insects when captured. The sugar-maple borer (*Clytus speciosus*, Say), the locust borer, (*C. robiniæ*, Forster), and the ash-tree borer (*C. capreæ*, Say,) belong to this group, which contains many of our most beautiful species.

The STENASPINI resemble the Clytini in their convex form, the thorax in both groups being almost globular, but are readily distinguished by their pointed scutellum and their style of coloration, being sometimes velvety-black, with a few large red spots, and sometimes almost wholly red or purple, but with the legs and antennæ black. The group is named from the genus *Stenaspis*, Serv., a word expressive of the narrow and pointed form of the scutellum. The species are usually of rather large size; but one of the most common, the *Batyle suturalis*, Say, is less than half of an inch in length, almost wholly red, and clothed with short erect hairs. The group contains about thirty species, many of which, however, are not found north of Texas.

Sub-family LEPTURIDES.

The Lepturides are named after the genus Leptura, of Linnæus, a term derived from the Greek *λεπτος—slender* or *attenuated*, in allusion to the slender and tapering form of most of the species.

[Fig. 76.]



LEPTURA.—After Westwood.

They are distinguished from the other Longicornes by their round eyes, sometimes entire, but usually with a small notch or indentation; by the head narrowed behind the eyes, and the thorax narrowed in front, the union of these two parts giving the appearance of a neck of greater or less length; and by the anterior coxæ being of an angular form and projecting below the level of the breast. The base of the elytra is usually more or less elevated above the level of the thorax. The middle cotyloid cavities are always open, and the eyes are almost always finely granulated. Their form is usually somewhat tapering behind, and as a general rule they are smaller and more active than the other Longicorns, and many of them fly by day, whereas most of the Longicorn beetles are crepuscular. Whilst most Longicorns are found upon the trunks of trees, and often near the roots, many of the Lepturides frequent flowers, especially those of umbelliferous plants.

It is in this sub-family that the species occur, which have very short or very narrow elytra. But in these cases the wings are not folded under them, as they are in the short-winged Staphylinidæ, but lie at their full length upon the abdomen. The larvæ differ from those of other Longicorns in having the head as wide as the body.

This group is usually placed at the end of the Longicornes, but we retain them here on account of their close alliance with the preceding sub-family of Cerambycides, with which they are united by Lacordaire.

The following are the genera of Lepturides:

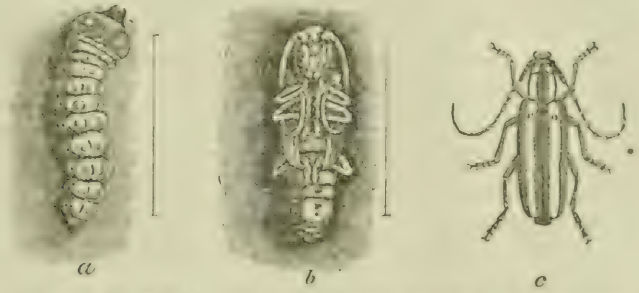
- A. Wing-cases of ordinary length.
  - B. Antennæ knotted, each joint being abruptly enlarged at its extremity............DESMOCERUS.
  - B B. Antennæ uniform.
    - C. Eyes entire. Antennæ approximate, and at some distance from the eyes.
      - D. Body oblong, depressed, parallel; elytra with elevated lines........................RHAGIUM.
      - D D. Body short and broad, mesosternum prominent, elytra blue....................GAUROTES.
      - D D D. Body oblong and moderately tapering; thorax without tubercles on the sides: ACMÆOPS.
    - C C. Eyes with a very shallow notch.
      - E. Hind tibiæ with a square excavation at the extremity, and with two long spurs at the upper angle. Shoulders much elevated, elytra tapering........................TOXOTUS.
      - E E. Tibial spurs moderate and terminal, or sub-terminal. Thorax with obtuse tubercles on the sides. Body moderately tapering..PACHYTA.
      - E E E. Body elongate slender, parallel; color blue................................ENCYCLOPS.
    - C C C. Eyes with a distinct notch; antennæ inserted close to the eyes. Thorax bell-shaped and without tubercles on the sides. First joint of hind tarsi without brush beneath.
      - F. Body moderately elongated...LEPTURA.
      - F. Body much elongated; abdomen much narrowed at its extremity..........STRANGALIA.
- A A. Wing-cases imperfect.
  - G. Wing-cases very short..MULORCHUS.
  - G G. Wing-cases nearly as long as abdomen, but slender and separated at their extremities...STENOPTERUS.

Desmocerus, Serv., contains two species, found on the blossoms of elder, one of which inhabits the Eastern States, and the other is found on the Pacific slope. The former is the *D. palliatus*, of Forster, a beautiful blue insect, eight or nine-tenths of an inch in length, with the basal third of the elytra a light buff-yellow, suggesting the idea of a cloak thrown over the shoulders, and expressed by the specific name *palliatus*. *Acmæops*, Lc., contains thirty-two described species; *Toxotus*, Serv., nine; *Pachyta*, Serv., eleven; *Strangalia*, Serv., seven; and *Leptura*, Linn., seventy-six, besides eleven other species separated by LeConte under the generic name Typocerus. The other genera contain but few species each. The *Rhagium lineatum*, Oliv., is five or six-tenths of an inch long, and of a grayish color. The larvæ burrow between the bark and the wood of the pitch-pine. *Garrotes cyanipennis*, Say, is between four and five-tenths of an inch long. The head and thorax are brownish-black, with an obscure tint of purple; the elytra are much broader than the thorax, and of a metallic greenish-blue color. The *Encyclops cœruleus*, Say, is a small, narrow, linear species, of a dark-blueish color, with reddish eyes. The eyes, as implied by the generic name, are perfectly round and without notch.

Sub-family LAMIIDES.

This sub-family is named from the genus *Lamia*, of Fabricius, a Greek word used to express some kind of bugbear, and suggested as the name of these insects, probably, on account of the menacing aspect of some of the larger species. They differ from all the other Longicorn beetles, (with a few rare exceptions,) in having their heads vertical, the front or forehead presenting a prominent angle, and the face falling perpendicularly below it, so that when viewed directly from above the face cannot be seen. This position of the head, in connection with their long curved horns, gives to these beetles a fanciful resemblance to a goat, and terms indicative of this similarity often occur in their nomenclature. They are also distinguished by the rather long and spindle-shaped last joint of their palpi, especially the maxillaries, and by a little groove almost always found on the inner face of their tibiæ. The granulations of the eyes, which are usually coarse in the Prionides and fine in the Lepturides, and which serve to separate the Cerambycides into two nearly equal sections, are so variable in the Lamiides as to be of but little value in classification.

[Fig. 77.]



SAPERDA BIVITTATA, Say; the Round-headed apple-tree borer:—*a*, larva; *b*, pupa; *c*, beetle—after Riley.

These insects generally remain stationary by day upon the trunks and branches of trees, and often escape detection by the resemblance which they bear, in the hues and sculpture of their bodies, to the color and inequalities of the bark on which they repose. Their colors are therefore, as a general rule, less vivid than those of the Cerambycides, their prevailing tints being brown and gray.

This is the most numerous sub-family of Longicornes, and is said to contain as many genera and species as the other three sub-families united; but in this country they do not appear to be more numerous than the Cerambycides.

The larvæ resemble those of the Cerambycides in being of a nearly cylindrical form, but a little tapering behind, and considerably swollen at the anterior extremity, with a small head, which is retractile within the enlarged anterior segment. These larvæ differ, however, from those of nearly all other Longicorns in being wholly destitute of legs.

A. Tarsal claws simple; body usually moderately elongated.

B. Pedicel, or first joint of the antennæ, cicatrised at the end; size large, usually an inch or more in length.................................... Monohammus.

B B. Pedicel without cicatrix or scar.

C. Middle cotyloid cavities open on the outer side; thorax usually unarmed, or, at most, with an obtuse tubercle at the side; thighs not at all, or but slightly clavate; size usually about medium.

D. Antennæ two or three times as long as the body, at least in the males; thorax longer than wide.

E. Antennæ naked; thighs linear, the hinder ones nearly as long as the abdomen: Dorchaschema.

E E. Antennæ hairy; hind thighs sub-fusiform, not reaching beyond the 2d abdominal segment.................................... Hippopsis.

D D. Antennæ never much longer, sometimes shorter, than the body; thorax not longer than wide, (except Adetus.)

F. Body ornamented with tufts of long hairs; thorax with a tubercle at the side; thighs sub-clavate.................................... Desmiphora.

F F. Body without tufts of hair.

G. Head very prominent; upper lobes of the eyes separate or wanting; legs very short: Spalacopsis.

G G. Head and eyes ordinary.

H. Legs rather long, thighs linear, the hind ones reaching the end of the 4th abdominal segment. Often rather large species.................................... Saperda, 13.

H H. Legs short; thighs sub-clavate or fusiform, not reaching at most beyond the 3d abdominal segment.

I. Body robust; antennæ longer than the body; lower lobes of the eyes elongated: Oncideres.

I I. Body more or less elongated; eyes ordinary.

K. Head retractile; thorax longer than wide; antennæ much shorter than the body; eyes deeply notched.................................... Adetus.

K K. None of the above characters.

L. Eyes coarsely granulated; size medium.................................... Ataxia.

L L. Eyes finely granulated; size small.

M. Antennæ hairy; elytra plane.................................... Eupogonius.

M M. Antennæ not hairy; elytra with a rounded elevation at the base: Psenocerus.

C C. Middle cotyloid cavities closed; thorax usually with a small spine or tubercle at the sides; antennæ longer than the body; hind thighs clavate, and reaching nearly to the end of the abdomen. Size usually below medium.

N. Size about medium; thorax with a spine at the middle of the sides.

O. First joint of antennæ rather short, and pear-shaped; female without ovipositor: Acanthoderes.

O O. First joint of antennæ elongate obconic; female with an exserted ovipositor: Graphisurus.

N N. Size below medium; body rather short and thick, thoracic tubercle obsolete: Leptostylus, 10.

N N N. Size much below medium; thoracic spine behind the middle of thorax........ Leiopus.

A A. Tarsal claws bifid at the end, or with a tooth near the base; body usually elongated and slender; antennæ about as long as, or shorter than the body.

P. Eyes completely divided; three intermediate segments of the abdomen shorter than the others.

Q. Claws bifid; body stout; size medium.................................... Tetraopes.

Q Q. Claws toothed at base; body slender; size small.................................... Tetrops.

P P. Eyes not divided; body elongated, slender, and parallel.

R. Four first abdominal segments equal, or gradually decreasing.

S. Claws bifid.

T. Hind legs elongated, thighs reaching the end of the 4th abdominal segment: Stenostola.

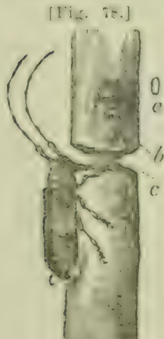
T T. Legs moderate, hind thighs not reaching the end of the 3d abdominal segment.................................... Phytœcia.

S S. Claws toothed at base; legs short.................................... Oberea, 13.

R R. Three intermediate segments of abdomen shorter than the others; head retractile.................................... Amphionycha.

Monohammus, Serv., contains ten described species. The antennæ of the males are about twice as long as the body, and in some species more than this, and the anterior legs are longer than the others, and their tarsi are strongly fringed with hairs. Certain species with shorter antennæ, and with the fore-legs of the males not elongated, have been separated by LeConte in the genus or sub-genus Goes. The genus *Ptychodes*, Serv., not given in the table, has most of the characters of Monohammus, but the thorax is rounded at the sides and without a lateral spine; but one species inhabits the United States; two others are found in Mexico and Central America. The genus *Saperda*, Fab., contains thirteen N. A. species, including the well known round-headed borer of the apple tree. *Leptostylus*, LeC., contains ten species, the most common of which is the *L. aculiferus*, Say, between three and four-tenths of an inch long, and of a gray color; thorax uneven; elytra rough with elevated points, with a brownish tip which is separated from the gray portion by a transverse whitish band. *Liopus*, Serv., contains many small species not averaging more than a quarter of an inch in length. Dr. LeConte makes the discriminative remark that in this genus and its allies, the lateral tubercle of the thorax becomes more acute and spiniform the farther back it is situated. The genus *Oberea*, Mulsant, contains thirteen species in our fauna, some of which are injurious to the raspberry, in their larva state. The other genera given in the preceding table contain but few species. *Oncideres*, Serv., contains three North American and many South American species. The only species found east of the Mississippi river is the *O. cingulatus*, Say, commonly known as the Twig-girdler, from the habit of the female of girdling twigs below the point where she has deposited her eggs. It usually breeds in the hickory, but it has been known to girdle the twigs of the apple, the pear, and the persimmon. We have referred above to the twig-pruning habits of the species of Elaphidion among the Cerambycides; but in that case, the pruning is done by the larvæ, whereas the amputation of the Oncideres is performed by the parent insect. *Tetraopes*, Dalman, contains the well known brick-red beetles with black spots, found on different species of Asclepias, or milk-weed. They are peculiarly N. American, the species being widely distributed from the Atlantic States to California.

[Fig. 78.]



ONCIDERES CINGULATUS, Say:—The Twig-girdler: *b*, hole made in depositing its egg; *c*, egg, natural size—after Riley.

TRIBE XIX.

TETRAMEROUS PLANT-BEETLES.

Herbivora tetramera. PHYTOPHAGA, Kirby.

This tribe embraces an extensive series of beetles, mostly of small size, not averaging much above a quarter of an inch in length, and rarely exceeding half an inch, and usually adorned with beautiful and often variegated colors. Like most other beetles of the tetramerous section, the tarsi are clothed with a brush of hairs beneath, and the third, or last joint but one, is usually more or less deeply bilobed. They are distinguished from the snout-beetles in the same section, by the absence of a rostrum or beak; from the short-horned borers, by their strongly dilated and bilobed tarsi, and from both by the antennæ not being knobbed at the end. They differ from the other family of tetramerous beetles—the long-horned wood-borers—in the comparative shortness of their bodies and of all their members, especially the antennæ, which are never tapering as they are in most of the Cerambycidæ, but are either filiform or slightly and gradually enlarged towards the tip. Some of the Cerambycidæ, however, have filiform antennæ, and there seems to be no character by which these two tribes can be absolutely distinguished from each other; and the genus Donacia occupies so intermediate a position between them that it has been placed sometimes in one, and sometimes in the other. But notwithstanding their close approach in a few of the connecting genera, scarcely any families of beetles are ordinarily more easily distinguished by their general form and aspect. The insects of the present tribe are pre-eminently phytophagous or plant-eating in their habits, both in the larva and imago states. The only beetles which can be compared with them in this respect are the chafers or leaf-eating Lamellicorns in the pentamerous section. We have had occasion, in the introductory part of this work, to state some of the differences in the habits of these two plant-eating tribes.

The Lamellicorns are, for the most part, much larger insects. They feed mostly upon the foliage of trees, in the beetle form, whilst their larvæ live under ground upon the roots of grasses and other plants; and they feed in the evening, clinging to the leaves by means of their long, sharp claws.

The tetramerous plant-beetles, on the contrary, are comparatively small insects; they feed mostly upon herbaceous plants, both in the larva and beetle state; they are diurnal in their habits, and move slowly over the surface of plants, to which they adhere by means of the dense brush of hairs on the under side of their feet.

The larvæ are for the most part short, fleshy, convex or hump-backed grubs, usually living upon the surface of the leaves upon which they feed, often in company with the mature insects. They have six thoracic legs, and usually a fleshy terminal proleg. Living exposed to the light they differ from the great majority of Coleopterous larvæ in being more or less highly colored. Some of them have the singular habit of protecting themselves by a covering of their own excrement, which will be described more fully in treating of the sub-family of Cassidides. But a considerable proportion of them are internal feeders. Some are leaf-miners; others inhabit the roots of herbaceous plants; and the larvæ of Donacia live concealed in the stems of water-plants, thus confirming their affinity with the preceding wood-boring tribe. These last mentioned larvæ exhibit a habit extremely rare amongst the Coleoptera, but which we have seen to be possessed by a few of the Curculionidæ, that of enclosing themselves in silken cocoons, when about to change to the pupa state. These cocoons are sometimes found fastened in a row to the stems of the aquatic plants in which the larvæ reside. Some phytophagous larvæ change to pupæ, attached to the leaves, but many of them go into the ground.

Being, as their name implies, pre-eminently plant-eaters, this tribe of beetles occupies a prominent place in practical entomology, on account of the many species which are injurious to the agriculturalist. Among these are the Striped cucumber-beetle, and its root-boring larvæ; the cabbage and turnip flea-beetles; the flea-beetle of the vine; and the tortoise-beetles which feed upon the sweet potato.

When danger threatens, the Chrysomelidæ do not usually attempt to escape either by running or flying, but, like the Curculionidæ, seek safety by contracting their limbs and falling to the ground.

With regard to the size of these insects, as compared with the Coleoptera in general, the same statement is applicable which we made above in treating of the Curculionidæ, and the terms large and small must be understood as being similarly modified; that is to say, half of an inch, which is about the medium length of beetles in general, is *large* when applied to the insects of these two families, quarter of an inch is *medium*, and an eighth of an inch or less is *small* or *very small*.

Family LXI. CHRYSOMELIDÆ.

This family, as here constituted, comprises the whole of the tribe of tetramerous plant-beetles. It is made up of several groups, some of which are sufficiently distinct, whilst others are more closely allied, thus rendering a natural classification of them indefinite, from the doubt whether certain groups should, or should not, be raised to the rank of sub-fami lies; and accordingly authors have differed much as to the number of primary divisions. Linnæus, having included Donacia in the long-horned genus Leptura, described the remainder of the present tribe under the three genera, Hispa, Cassida and Chrysomela. And if we take these, as we do most of the Linnæan genera, as types of families, it may well be questioned whether any more obvious or natural classification of these insects can be suggested to-day.

Latreille, in the Règne Animal, divided them into two families, which he designated by the names *Eupoda*, signifying largely developed legs; and *Cyclica*, in allusion to the circular or rounded form of most of the species. The former includes Donacia, Crioceris and the exotic genus Sagra. The more extensive family of Cyclica he divided into three tribes, which are equivalent to our sub-families, viz: the Cassidariæ, the Chrysomelinæ, and the Galerucitæ. These divisions he founds partly upon the habits of the larvæ, which he divides into four kinds: 1st, those which cover their bodies with their excrement, (Cassidariæ); 2d, those which live exposed on leaves, (Chrysomelinæ proper); 3d, those which inhabit tubes which they drag about with them, (Cryptocephalus and certain other genera of Chrysomelinæ); and 4th, those which live concealed in the interior of leaves, feeding on their parenchyma, (Haltica, and its sub-genera, among the Galerucitæ).

This arrangement of Latreille seems to us much less natural and satisfactory than are usually the classifications of this eminent entomologist. By it the small division of Eupoda is made to hold a rank equivalent to all the rest of the Chrysomelidæ combined, and yet its most common and numerous genera (Crioceris, Orsodacna, etc.), bear a close resemblance to some of the Galerucides, and do not differ from many of the Cyclica, either in form or the habits of their larvæ, so much as the sub-family of Hispides. Moreover, the family name of Eupoda applies with but little force to many of these common species, though it is very appropriate to some of the foreign genera. With respect to the habits of the larvæ, however interesting in themselves, they furnish a very imperfect basis of classification, since most of the habits above referred to are common to several of the sub-families.

Mr. Westwood admits four primary divisions, which he raises to the rank of families, viz: Crioceridæ, Cassididæ, Galerucidæ, and Chrysomelidæ. Dr. LeConte has published a number of able papers upon the Chrysomelidæ of North America, but being scattered through various scientific periodicals, they are not very accessible to the general student.

In a recent volume of the Proceedings of the Academy of Natural Sciences, of Philadelphia, Mr. G. R. Crotch, with the assistance of Drs. LeConte and Horn, and with the aid of their extensive cabinets, has published a pretty full synopsis of the Phytophaga of the United States, which I have found of much use in preparing the following tables of genera. Mr. Crotch unites all the Phytophaga in the family of Chrysomelidæ, which he divides into ten sub-families, as follows: Donaciides, Orsodacnides, Criocerides, Melolonthides, Cryptocephalides, Chrysomelides, Eumolpides, Galerucides, Hispides and Cassidides.

The Orsodacnides do not seem to us to be sufficiently distinct from the Criocerides, nor the Melolonthides (questionably so called) from the Crytocephalides, nor the Eumolpides from the Chrysomelides, to be retained as of equal rank. We will therefore divide the Chrysomelidæ into the seven following sub-families. The accompanying tables of the minor groups exhibit a pretty full synopsis of N. American genera, excepting a few which are composed of but one or two rare species, usually from the remote West:

A. Body elongated; thorax not margined at the sides; head slightly constricted behind the eyes; eyes prominent; thighs usually more or less thickened.
  B. Body much elongated; first ventral segment very long; larvæ live in the stems of plants... .... DONACIIDES.
  B B. Body moderately elongated; first ventral segment not much longer than the others; larvæ live on the leaves of plants, sometimes cover themselves with excrement .... CRIOCERIDES.
A A. Body more or less rounded (except Hispides); thorax almost always margined; head not constricted; eyes not prominent; thighs not swollen (except in Haltica and its sub-genera.)
  C. Antennæ distant, being wider apart at base than the length of the first joint.
    D. Body oval; abdomen wholly covered by elytra; larvæ live exposed on leaves .... CHRYSOMELIDES.
    D D. Body usually short and sub-cylindrical; tip of abdomen vertical and uncovered; larvæ live on leaves, in portable cases. CRYPTOCEPHALIDES.
  C C. Antennæ approximate, being rarely wider apart than the length of the first joint.
    E. Antennæ filiform and at least half as long as the body; hind thighs, in one division, enlarged for jumping; larvæ live on leaves or between their laminæ .... GALERUCIDES.
    E E. Antennæ less than half as long as the body, and more or less thickened towards the tip.
      F. Head exposed; form oblong and usually sub-quadrate; surface usually strongly pitted or reticulated; larvæ live between the laminæ of leaves .... HISPIDES.
      F F. Head concealed under the thorax; form hemispherical; surface usually smooth; larvæ live on leaves, covered by excrement:
CASSIDIDES.

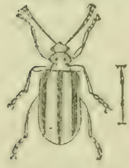
Sub-family DONACIIDES.

This sub-family, composed mostly of the genus *Donacia*, Fab., forms a connecting link between the Lepturides of the preceding family and the Criocerides of the present. Their form is considerably elongated, and they can be distinguished with certainty by the unusual prolongation of the first ventral segment, which is as long as all the others combined. They are between a quarter and half of an inch in length, and with a dark metallic lustre, of a greenish, bronze or purplish hue. The under side is paler, and clothed all over with an extremely fine silken prostrate pubescence, which enables them to shed the water, when the aquatic plants upon which they reside happen to be submerged. The species often closely resemble each other, rendering it difficult to draw the line between species and varieties. The larvæ inhabit the stems of aquatic plants. When about to transform, they enclose themselves in silken cocoons, which are sometimes attached in rows upon the outside of the plants.

Mr. Crotch enumerates twenty-five species as inhabiting the United States, two of which he describes as new, and refers the reader for a full description of the others to Dr. LeConte's Synopsis in the Proc. Acad. Nat. Sc., of Philadelphia, for the year 1852.

Sub-family CRIOCERIDES.

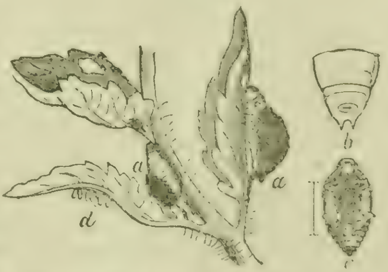
[Fig. 79.]



CRIOCERIS (Lema) TRILINEATA, Oliv.

This sub-family takes its name from the genus *Crioceris*, of Geoffroy, a word which literally means a *ram's horn*, but which is not especially appropriate to these insects, unless it be by way of expressing their relationship to the preceding family of Cerambycidæ, in which the resemblance of the antennæ to the horns of the ram and the goat is much more striking. Like them, also, some of the beetles of the present sub-family have the faculty of making a squeaking noise, by the friction of one part of their bodies upon another. The Criocerides differ from the great majority of Chrysomelidæ, in having the thorax almost cylindrical and without a lateral margin, and more decidedly narrower than the abdomen. The antennæ are somewhat moniliform, of the same width throughout, and about half as long as the body. The larvæ live exposed on the leaves upon which they feed; but some of them, of which the common Three-lined potato-beetle is an example, have the remarkable habit of protecting themselves by a covering of their own excrement. To enable them to accomplish this purpose, the anal opening is upon the upper side of the last segment, and the excrement is pushed forwards upon the back by the pressure of that which is subsequently evacuated. The Criocerides of this country are contained in two leading genera:

[Fig. 80.]



LEMA TRILINEATA, Oliv.:—*a a*, larvæ; *c*, pupa; *d*, eggs; *b*, two last segments of the larva, showing the anal aperture on the upper side of the last segment—after Riley.

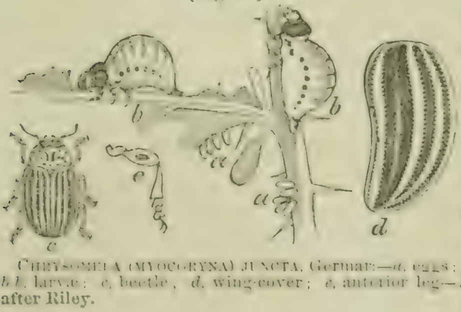
A. Last joint of palpi widened and truncated; claws toothed........................ORSODACNA.
A A. Last joint of palpi not wider than the others and pointed; claws simple..............CRIOCERIS.

Orsodacna, a name taken from the Greek and meaning a *bud-gnawer*, was originally applied to some insect now unknown, which was injurious to fruit trees. It includes three sub-genera: *Orsodacna*, Latr., having the thorax uniform and the eyes entire; *Zeugophora*, Kunze, having the eyes notched and the thorax with a lateral tubercle; and *Syneta*, Esch., with several short teeth at the sides of the thorax. The species are of moderate size, and either blackish or dull yellow, but more commonly with both of these colors combined. We have twelve species, some of which are very variable, and have been described under different names. The only species of Crioceris proper found in the United States, is the imported asparagus beetle, *Crioceris asparagi*, Linn., which has become naturalized in some of the Eastern States. Most of our species are now placed in the sub-genus *Lema*, Fabr., as restricted by Lacordaire, and distinguished by having the thorax constricted or narrowed a little behind the middle. The most common species is the *Lema trilineata*, Olivier, or the Three-lined potato-beetle, a quarter of an inch long, yellow, with three black stripes on the elytra. Mr. Crotch enumerates twelve other species, most of which inhabit the Southern States.

Sub-family CHRYSOMELIDES.

This sub-family is founded upon the typical genus *Chrysomela*, of Linnæus, a word which literally means a *golden apple*, and which was obviously given to these insects in allusion to their rounded form and beautiful colors, which not unfrequently exhibit a golden hue. Their most distinctive scientific character, as compared with the other sub-families of this tribe, is the distance from each other of the antennæ at their points of attachment, being always farther apart than the length of the first joint, and often two or three times as far, taken in connection with the gradual but slight enlargement of these organs towards the tip. The sub-family comprises two well-marked groups, which are regarded by some entomologists as distinct sub-families, and which may be designated by the terms of Chrysomelini and Eumolpini. In the former the thorax is transversal, that is, wider than it is long, strongly margined, and as wide at base as the elytra; the antennæ are moderately robust, sub-moniliform, and almost always less than half as long as the body; the anterior coxæ are transverse; the 3d joint of the tarsi

[Fig. 81.]



CHRYSOMELA (MYOCORYNA) JUNCTA, Germar:—*a*, eggs; *b b*, larvæ; *c*, beetle; *d*, wing-cover; *e*, anterior leg.—after Riley.

is scarcely bilobed, and the claws are usually simple. In the latter, the thorax is very convex, narrower than the abdomen, and with the margin indistinct or wanting; the antennæ are slender, almost filiform, and about half as long as the body; anterior coxæ globose; the third joint of the tarsi is deeply bilobed, and the claws are bifid.

The larvæ live exposed on the leaves of herbaceous plants, upon which they feed. We do not know of any larva in this sub-family which covers itself with excrement, unless we admit into it the intermediate genus *Blepharida*, which we have preferred to unite with the other saltatory species.

The following are the genera of *Chrysomelini*:

A. Third joint of tarsi entire or slightly notched at the end; posterior episterna usually narrowed behind.
  B. Form regularly oval and strongly convex; tarsi entire; color usually yellow, with darker stripes or spots; length between a quarter and a half of an inch........................CHRYSOMELA.
  B B. Form oval or oblong oval, convex; third joint of tarsi notched; color metallic-green or blue; length less than quarter of an inch........................GASTROPHYSA.
  B B B. Form short and round or sub-globuse; dark metallic without spots; length much less than quarter of an inch........................PHÆDON.
  B B B B. Form oblong, narrow, parallel, depressed; antennæ strongly clavate; dark metallic, with a few yellow stripes; length much less than quarter of an inch..............PRASOCURIS.
A A. Third joint of tarsi deeply bilobed; posterior episterna parallel; form oblong oval and depressed; colors various; size same as Chrysomela........................PLAGIODERA.

The following are the genera of *Eumolpini*:

A. Body smooth and shining.
  B. Thorax lobed behind the eyes.
    C. Elytra irregularly punctured; claws with a tooth beneath.
      D. Antennæ robust, somewhat clavate; color golden-green or blue; length a third of an inch or more........................CHRYSOCHUS.
      D D. Antennæ long and filiform; color golden-green or bronze; length a quarter of an inch or less........................TYPOPHORUS.
    C C. Elytra punctured in rows; claws bifid; size small; color brown with black spots, rarely wholly black........................PARIA.
  B B. Thorax not lobed behind the eyes.
      E. Second joint of the antennæ shorter than the third; elytra densely but irregularly punctate........................COLASPIS.
      E E. Second and third joints of antennæ equal; elytra punctured in rows......METACHROMA.
A A. Body more or less clothed with hair or scales.
      F. Thorax without a margin at the sides.
        G. Body shining, bronze, rarely green; punctures indistinct; sparsely haired..HETERASPIS.
        G G. Body obscure, brown, coarsely punctured.
          H. Thorax longer than wide; body densely haired; size about medium..........FIDIA.
          H H. Thorax wider than long; body moderately haired; size small........XANTHONIA.

The genus Chrysomela has been divided into a number of sub-genera which can generally be distinguished by their style of coloration, as follows: *Labidomera*, Chevr., dark-yellow, with a few large blue-black spots; *Myocoryna*, Stål., usually with the elytra pale-yellow, with four or five darker stripes on each; *Zygogramma*, Chevr., elytra with two or three stripes more or less united; *Calligrapha*, Chevr., elytra with numerous irregular lines and dots; and *Chrysomela*, Linn., blackish or golden, without stripes; but there are some exceptions to these general rules which we shall notice below. *Labidomera* contains one common species, the *L. trimaculata*, Fab., found on milk-weed. *Myocoryna* contains the destructive potato-beetle commonly known as the *Doryphora 10-lineata*, and the allied but much less common species *D. juncta*, and two other similar species found in Texas and Mexico. The generic name *Doryphora*, means a *spear-bearer*, in allusion to the pointed anterior prominence of the mesosternum, and was originally applied by Illiger to a similar group of insects from South America. But in our species the mesosternum is not produced to a point, and therefore M. Stäl, a Sweedish entomologist, has formed a new genus for them under the name of Myocoryna, from the Greek *mus*—to *compress*, and *koruna*, a *club*—the club of the antennæ being slightly flattened.

This is one of the exceptional genera with respect to color, being usually striped, but one species is wholly blue, and another is wholly red. *Zygogramma*, implying literally that the *stripes* are united or *yoked together*, contains a number of common species which are subject to considerable variation. *Calligrapha*, meaning *beautiful writing*, contains some of our most elegant beetles, distinguished by the numerous metallic marks and dots on their almost white elytra. The species are numerous and often variable. Mr. Crotch admits thirteen species as inhabiting the United States; a few of them depart from the normal style of coloring, and resemble *Zygogramma*. The organic distinction between the two genera is, that in *Zygogramma* the claws are approximate and the claw joint toothed beneath; and in *Calligrapha*, the claws are distant and the claw joint simple.* *Chrysomela* proper is now restricted to a small number of dark colored species, some of which have a golden lustre. One species from Colorado and the neighboring States is black, with a yellow border to the elytra.

Gastrophyza, Chev.,—meaning *abdomen inflated*—alludes to the remarkably swollen condition of the abdomen of the females when filled with eggs. It contains one of our prettiest and most common beetles: the *G. polygoni*, Linn., common to both Europe and this country. It is three-twentieths of an inch long, of a brilliant blue-green color, with a yellow thorax. It feeds upon the common knot-weed (*Polygonum aviculare*.) Mr. Say described it as a rare insect under the name of *Chryso-*

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*It is a question whether in grouping certain insects—such, for example, as the Chrysomelides—the plan of coloration should not have more weight, in comparison with slight organic characters. It is evidently unnatural to separate such species, with striped elytra, as *elegans*, Olivier, and *similis*, Rogers, from the similarly marked *Zygrogramma pulchra* and *exclamationis*, Fab., and *conjuncta*, Rogers, and unite them with the dissimilar and dotted group of Calligrapha, upon a character so variable, and therefore unimportant, as is the structure of the tarsal claws, in the whole family of Chrysomelidæ.

But we have been gratified to see, since the above was written, that Mr. Crotch, in his recent Check-list of Coleoptera, has suppressed all these sub-genera, and recognized them only as sections of the original genus Chrysomela, of Linnæus; a course which, it seems to us, might be profitably adopted with respect to many modern genera.

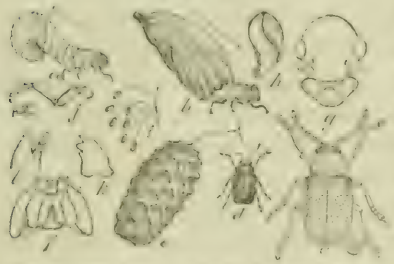
mela cæruleipennis. Say also described two other and similar species, but without the yellow thorax, which he accredits to the Missouri territory. *Phædon*, Chev., contains a few small species, the type of which is the *P. viride*, of Melsheimer. *Prasocuris*, Latr., contains three species, none of which are common. *Plagiodera*, Chev., is composed of a number of species of very variable color, and even the same species, as in the cases of the not uncommon *P. scripta* and *P. interrupta*, which are ordinarily yellow with blackish spots, are sometimes found wholly blue-black or green. This genus was formerly known as *Melasoma*, Dillwyn; but the name is not properly applicable to the species, and besides was pre-occupied by Latreille—as we have seen in a former part of this work—as the general name of the black-bodied heteromera. It has been therefore replaced by *Plagiodera*, Chevrolat, meaning *transverse thorax*, and applied to them because the thorax is much wider than it is long.

Chrysochus, Chev., in the group of Eumolpini, meaning literally a *goldsmith*, is the generic name of the beautiful golden-green beetle, about four-tenths of an inch long, found on the dogs-bane and other species of *Apocynum.* It has usually been referred to the genus Eumolpus, but is now known as the *Chrysochus auratus*, Fabr. It is common throughout both the Eastern and Western States, and has been found as far west as Arizona. Another similar species, but usually a little larger and of a deep blue-green color, has been found in Oregon and California. It is the *Ch. cobaltinus*, of LeConte. *Typophorus*, Chev., contains three closely allied species, the type of which is the *T. tricolor*, Fab., found in the Middle and Southern States. The next five genera—*Paria*, *Colaspis*, *Metachroma*, *Heteraspis* and *Xanthonia*—contain a large number of small, brown insects, though some species of Colaspis have a metallic lustre. *Paria* is distinguished from the others by the ear-like lobes on the anterior margin of the thorax, which partly cover the eyes. The same lobes exist in Chrysochus, but are situated lower down. The genus *Fidia*, of Dejean, is composed of a somewhat larger species, of a dark chestnut or blackish color, but with a mealy surface produced by dense, short, prostrate hairs. The insects of this genus have an economic interest in consequence of damage done by them to the leaves of the grape-vine. The leading type is the *F. viticida*, Walsh. Dr. LeConte regards the *longipes*, Mels., and the *viticola*, Uhler, as only varieties of this species.

Sub-family CRYPTOCEPHALIDES.

This group is founded upon the genus *Cryptocephalus*, of Geoffroy, a term meaning *concealed head*, and given to these insects because the head is so deeply immersed in the strongly convex thorax that it can be scarcely or not at all seen when viewed from above. The pygidium

[Fig. 82.]



Coscinoptera dominicana:—*a*, larva extracted from case; *b*, do. with case; *c*, beetle showing punctures; *d*, same natural size; *e*, egg enlarged; *f*, head of larva, under side; *g*, head of male beetle; *h*, jaw of same; *i*, eggs natural size; *j*, leg of larva; *k*, jaw of same; *l*, maxilla of same—after Riley.

or last segment of the abdomen is bent vertically downwards, and left uncovered by the elytra, furnishing an easily distinguishable character which is common to nearly all the species, except those specified in the following synopsis, and which is found in none of the other sub-families. The antennæ are rather distant at their insertion, sometimes short and serrate, but in the majority at least half as long as the body, and very slender and filiform. The third joint of the tarsi is always deeply bilobed. They are all small insects, rarely attaining a quarter of an inch in length. All the larvæ, we believe, so far as known, live upon the surface of leaves, and have the curious habit of enclosing themselves in compact cases, composed of their own excrement, which they mould into shape by means of their mandibles. The same habit of economizing the particles of excrement is practiced by many of the small caterpillars belonging to the lepidopterous family of Tineidæ. The larvæ carry their cases about with them, by protruding the anterior part of their bodies through the open extremity. When about to transform they attach their cases to the twigs, and close the opening, thus making them answer the purpose of a cocoon.

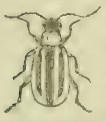
A. Antennæ serrate or sub-clavate, and shorter than the head and thorax.
  B. Body elongate; abdomen wholly covered by elytra; antennæ serrate..................Anomœa.
  B B. Body short, oval or subcylindric; tip of abdomen exposed.
    C. Body short, thick and tuberculous; antennæ small, sub-clavate and sub-serrate, legs closely contractile..Chlamys.
    C C. Body not tuberculous; antennæ free; legs not contractile.
      D. Tip of abdomen scarcely exposed; elytra smooth and shining, finely punctured; antennæ sub-serrate..Babia.
      D D. Tip of abdomen fully exposed; elytra coarsely punctured or pubescent.
        E. Antennæ sub-serrate; elytra densely punctured..................................Saxinis.
        E E. Antennæ serrate; elytra irregularly punctured and pubescent; mandibles large: Coscinoptera.
A A. Antennæ slender and filiform, and longer than the head and thorax..........Cryptocephalus.

The genus *Anomœa*, Lacord., has for its type the common *A. laticlavia*, Forster, from a quarter to a third of an inch in length, and of a clay-yellow color, with the suture and margin of the elytra black. The generic name means *dissimilar*, in allusion to the departure of the species from the ordinary characters of the sub-family, but their place here is determined by the serrate antennæ, and more especially by the case-bearing habit of their larvæ. Another species very differently colored is found in Texas. The species of *Chlamys*, Knoch, are of a dark brown color, and when their limbs are contracted they resemble little rough balls of inanimate matter. The most common species is the *C. plicata*.

Fab., three-twentieths of an inch long. A much smaller species, the *C. dispar*, Lacord., has been placed in the sub-genus *Exema*. *Babia*, Chev., is founded upon the *B. biguttata*, Oliv., and its varieties. It is about three twentieths of an inch long, blue-black, with a fulvous spot on the shoulder, and another at the tip of each elytra. It differs from the great majority of Cryptocephalides in having the tip of the abdomen but slightly, and in many specimens not at all exposed. *Saxinis omogera*, Lacord., resembles the last mentioned insect in size and color, except that there is no spot at the end of the elytra. It is found in the Southern States and Texas. The genus contains but one other North American species. The type of the genus *Coscinoptera*, Lacord., is the *C. dominicana*, Fab. (Fig. 82), two-tenths of an inch long, or a little more, black, rather densely covered with a fine ash-colored pubescence. Several other species have been found in the remote Western States. The *C. vittigera*, LeC., found in Kansas, is more oblong, and each elytra has a fulvous stripe, which is bent up like a hook at the end. The generic name comes from *koskinos*—a *sieve*, and *ptera*—wings, referring to the irregularly distributed punctures, somewhat like the holes in a sieve. The genus *Cryptocephalus* contains many more species than all the others combined. It has been divided into a considerable number of sub-genera, mostly upon slight or obscure characters. A more convenient distribution, for the purpose of identification of species, could be made in accordance with their colors. The majority are brown, with yellow stripes or spots; a considerable number are blue-black, with rufous or orange spots; and some of the smallest species are wholly blue-black or brown.

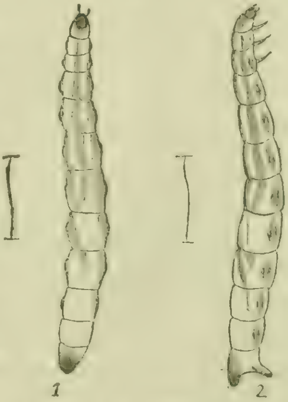
Sub-family GALERUCIDES.

[Fig. 83.]



GALERUCA (DIABROTICA) VITTATA, Fa.: The Striped cucumber-beetle.

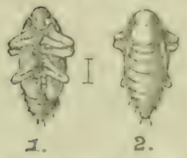
[Fig. 84.]



DIABROTICA VITTATA:—Larva greatly magnified, the side lines showing the length of the fully grown larvæ: 1, back view; 2, side view—after Riley.

Named after the genus *Galeruca*, of Geoffroy. They are distinguished primarily from the other Chrysomelidæ by the approximation of the antennæ at their points of insertion, being rarely farther apart than the length of the first joint, and from the Chrysomelides proper by having the antennæ perfectly filiform, or not enlarged towards the tip. The thorax is narrower than the elytra, which, together with a similarity of coloring, gives to some of the species a strong resemblance to the Criocerides, but they can always be distinguished by the thorax having a distinct lateral margin or edge. It is in this sub-family that we find a large proportion of the injurious Chrysomelidæ, such as the Striped cucumber-beetle, and the various species of flea-beetles, so injurious to the vine, the cucumber, and the Cruciferæ, or plants of the cabbage and turnip family; and they furnish a remarkable exception to noxious insects in general by being usually most injurious in the perfect or beetle form. But some of them, like the Cucumber-beetle, (*Diabrotica vittata*,) also cause the death of the plants by burrowing into the roots in their larva state. Some of the species, like the European *Galeruca calmariensis*, and the little bronze flea-beetle, *Haltica helxines*, which is common to Europe and this country, depart from the usual habits of the family in devouring the foliage of trees, whereas the great majority of Chrysomelidæ feed upon herbaceous plants. The habits of the larvæ are various, those of Galeruca feeding exposed upon the surface of leaves; those of Diabrotica boring into roots, and those of Haltica sometimes feeding upon roots, but usually mining between the laminæ of leaves.

[Fig. 85.]



DIABROTICA VITTATA.—Pupa: 1, ventral; 2, dorsal view—after Riley.

The sub-family is divided into two distinct groups: the *Galerucini*, with the thighs not thickened, and the anterior coxæ not separated by the prosternum; and the *Halticini*, having the anterior coxæ separated by a projection of the sternum, and the hind thighs greatly enlarged, which gives them the power of jumping, and from which the name of *flea-beetles* is derived. The following are the principal genera:

A. Hind thighs not thickened. (*Galerucini.*)
  B. Thorax wider than long; first joint of antennæ shorter than the second and third united; color usually dull brownish, sometimes with black stripes.................................GALERUCA.
  B B. Thorax almost square, with rounded corners; first joint of antennæ as long as second and third united; colors usually yellow and black combined.........................DIABROTICA.
  B B B. Thorax usually a little wider than long; second and third joints of antennæ about equal; size small; color brown or metallic black, or blue, and without spots............LUPERUS.
A A. Hind thighs enlarged for jumping. (*Halticini.*)
  C. Antennæ distant, slightly thickened towards the tip; claws bifid.................BLEPHARIDA.
  C C. Antennæ approximate, filiform, claws simple or dentate.
    D. Last joint of hind tarsi swollen.
      E. Elytra glabrous; size about medium; colors various.......................ŒDIONYCHIS.
      E E. Elytra hairy; size small; color brown..HYPOLAMPIS.
    D D. Last joint of hind tarsi not inflated.
      F. Elytra irregularly and finely punctured; size medium or small.
        G. Body oval; thorax wider than long.
          H. Thorax with an impressed transverse line before the base; color blue-black: GRAPTODERA.
          H H. Thorax without impression.
            I. Tarsi of ordinary form.
              K. Second joint of antennæ shorter than the third; size medium; colors various: DISONYCHA.
              K K. Second and third joints of antennæ equal; size small; color dark metallic; elytra usually with one yellow stripe..........................ORCHESTRIS.
            I I. First joint of hind tarsi as long as the others united, size very small; color brownish.. [illegible]
        G G. Body elongate; thorax about as long as wide; size small; color black, sometimes striped with yellow.............................. [illegible]

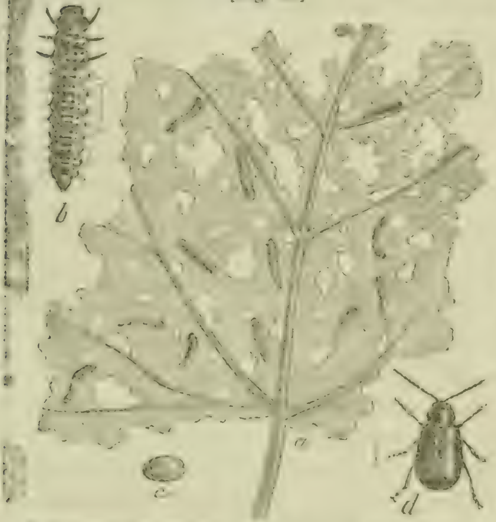
F F. Elytra punctured in rows; size very small, without spots or stripes.
  L. Antennæ with eleven joints; hind tarsi normal.
    M. Hind tibiæ robust, and terminated by a bifid spur; body perfectly oval; head deeply immersed in the thorax; size small; color brassy-black...DIBOLIA
    M M. Hind tibia toothed and furrowed on the outer side; very small; blue or brassy..CHÆTOCNEMA.
    M M M. Hind tibia normal; thorax with a deep impression near the base; color dark metallic or reddish..............................CREPIDODERA.
  L L. Antennæ ten-jointed; hind tarsi attached to the side of the tibia: PSYLLIODES.

Galeruca, Geoff., contains a considerable number of species, some of which are common but inconspicuous. *Diabrotica*, Chevr., has been divided into a number of sub-genera, agreeing in size and form, but the more common species are readily distinguished by their color, *Diabrotica* proper being usually pale yellow with black spots or stripes, *Phyllobrotica*, Dej., being tawny or orange with black spots or stripes, and *Phyllecthrus* being blue black with a yellow thorax. Diabrotica means one that *gnaws through*; Phyllobrotica, a *leaf-gnawer*; and Phyllecthrus, a *leaf-enemy*; all of which terms have reference to their leaf-eating and often destructive habits.

The Striped cucumber-beetle is the *D. vittata*, Fab. *Luperus*, Geoffr., also meaning *injurious*, contains a few small species, some of which are of rich metallic colors; but none of our species are sufficiently numerous to be injurious. *Blepharida*, Chev., forms a connecting link between Haltica and Chrysomela, having the oval form and distant antennæ of the latter, and the enlarged thighs of the former. It contains but two species, one of which is the *B. rhois*, of Forster, a mottled reddish beetle, quarter of an inch long, found abundantly on the sumach. *Œdionychis*, Latr., contains many species, most of which do not vary much from a quarter of an inch in length. The most common style of coloration is that of a yellow thorax and dark metallic elytra, but some are brown or yellow with black stripes. In these, as in all the larger Halticini, the elytra are irregularly punctured, whilst in most of the small species they are punctured in rows. The generic name is expressive of the swollen claw-joint.

Hypolampsus, Clark, contains three N. A. species, the most common of which is the *H. pilosa*, of Illiger. *Graptodera*, Chevr., is composed of a number of dark blue species, one of which is the *Haltica (Graptodera) chalybea*, Illig., the destructive steel-blue flea-beetle of the grape vine. *Disonycha*, Chev., is scarcely distinguishable from Œdionychis except in the hind claw joint not being swollen. The species of the two genera, or more properly sub-genera, often closely resemble each other in size and color, but in Disonycha the style of coloration is most common which is exceptional in Œdionychis, namely, yellow with black stripes; but the most common species is black with a yellow thorax, on which are

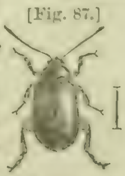
[Fig. 86.]



HALTICA (GRAPTODERA) CHALYBEA, Illiger:—The Grape-vine flea-beetle; *a*, grape leaf eaten by young larvæ; *b*, larva, magnified; *c*, earthen cell, in which the insect transforms; *d*, beetle—after Riley.

three black dots arranged in a triangle; length a quarter of an inch; this is the *D. triangularis*, Say. Another species liable to be confounded with this is the *D. collaris*, Fab., but in this the thorax is yellow without spots, and the under side of the abdomen is dull yellow. *Orchestris*, Kirby, is the genus which contains the common cabbage and turnip flea-beetle, and its allies. They are about one-tenth of an inch long, black, with a broad waving yellow stripe along the middle of each wing-cover. Species closely resembling each other are equally abundant and destructive in Europe and in this country. The generic name means a *dancer* or *jumper*. *Longitarsus*, Latr., contains many small and closely allied species of a brownish color, and distinguished as the name implies by the greatly elongated first joint of the hind tarsi. *Systena*, Chev., is most readily distinguished by the elongate, narrow form of the species. The *Systena blanda*, Melsh., an eighth of an inch long, pale yellow with three darker stripes, has been found to be destructive to young corn, in the Middle States. The other genera in the table are composed of very small species, distinguished from the foregoing by having the elytra punctured in rows. *Dibolia*, Chev., contains but one known species, the *D. aerea*, Melsh., or brassy Dibolia, a tenth of an inch or a little more in length and of a brassy black color; found in the Middle and Southern States. The species of *Chætocnema*, Stephens, are found mostly in the Southern States and Texas. *Crepidodera*, Chev., contains many very small, usually black or reddish species; but one of the most common, the *C. helxines*, Linn., is sometimes purple and at others brassy green. This little species is said to be common to Europe and this country. The little Cucumber flea-beetle, *Haltica cucumeris*, of Harris, has been placed, in company with a few others, in a separate sub-genus *Epitrix*, Foudr., on account of their pubescent surface. But few species of the little genus *Psylliodes*, Latr., have been observed. Dr. Fitch refers to one of them, the *P. punctulata*, Melsh., as being somewhat injurious to the leaves of several kinds of garden vegetables. The generic name is de-

[Fig. 87.]

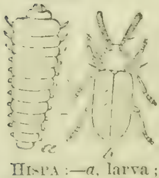


HALTICA CHALYBEA, Illiger: showing the swollen posterior thighs.

rived from a Greek word meaning a *flea*, in allusion to their power of leaping.

Sub-family HISPIDES.

[Fig. 88.]



HISPA:—*a*. larva; *b*. beetle—after Westwood.

This sub-family is founded upon the genus *Hispa*, of Linnæus, a contraction of the Latin word *hispida*, meaning *rough*, in allusion to the deep sculpturing of the elytra, which usually consists in a number of elevated ribs with a double series of deep punctures between them. The antennæ are short, straight, compact, closely approximate at base and regularly divergent at tip. These characters, together with their oblong and usually somewhat quadrate form, renders them one of the more easily recognizable groups in the whole order of Coleoptera. They are usually about a quarter of an inch in length or a little less, and their colors are black and red, either singly or combined. They seem to be a good deal confined to particular localities, and therefore are not very commonly met with. The larvæ are leaf-miners, feeding between the upper and lower laminæ. They differ in form from other Chrysomelide larvæ, and resemble more the larvæ of the Cerambycidæ, the head being much narrower than the body, and the three first segments being wider than the following ones. Their form and habits were first described by Dr. T. W. Harris, from species found upon the Oak, the Apple and the Locust.

The Hispides present two strongly marked genera: *Hispa*, moderately elongated and with strongly sculptured elytra, and *Stenispa*, much elongated and narrow, and with the elytra smooth and shining, and very faintly puncto-striate. The latter contains but two known species: the *metallica*, Fab., of a shining brassy black color, not quite a quarter of an inch long; and the *collaris*, of Baly, similar but having the thorax red. The former is widely distributed, and the latter inhabits the Indian Territory.

Hispa proper is limited to the small black European species, originally described by Linnæus, to which the term *hispid* is peculiarly appropriate, being beset with minute spines. The American species have been divided into two genera:

A. Antennæ 11-jointed; sculpture regular and distinct.................................ODONTOTA.
A A. Antennæ 8-jointed; sculpture usually irregular or imperfect..................MICRORHOPALA.

The regular sculpturing consists of deep punctures upon the thorax, and elevated ribs *(costæ)* upon the elytra, with a double row of numerous punctures between them. The species of *Odontota*, Chev., (same as *Anoplitis*, Kirby,) may be arranged according to their color, as follows. The length of each species is added in decimals of an inch; thus 0.24 expresses twenty-four hundredths of an inch.

- Wholly black: *nigrita*, Oliv., 0.16.
- Black varied with red:
  - Thorax red and elytra black: *bicolor*, Oliv., 0.25: *Ariadne*, Newm., 0.18: *Walshii*, Crotch, 0.14: *Lecontei*, Baly, 0.20.
  - Thorax red only at the sides, elytra black: *notata*, Oliv., 0.24.
  - Sides of thorax and shoulders of elytra red: *scapularis*, Oliv., 0.25: *omogera*, Crotch., 0.31.
- Wholly or mostly red:
  - Wholly red: *rubra*, Weber, 0.20.
  - Red with a black suture: *Harrisii*, Crotch, 0.24.
  - Red usually with obscure brown or blackish spots: *quadrata*, Fab., 0.24: *rosea*, Web., 0.15.

Microrhopala, Chev., (meaning a *little club*,) is distinguished by having the antennæ apparently 8-jointed, the four last joints being consolidated, to which the generic name refers. The sculpture is usually either irregular or imperfect, as expressed in the following table of species:

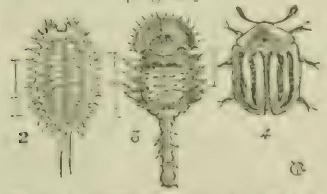
- Ribs of elytra indistinct, and with fewer punctures.
  - Thorax and stripe on base of elytra red: *vittata*, Fab., and variety *lætula*, Lec., 0.23.
  - Sides only of thorax and stripe on elytra red: *xerene*, Newm., 0.17.
- Ribs more or less confounded with the few and large punctures:
  - Punctures moderate and somewhat regular, color blue: *cyanea*, Say, 0.23.
  - Punctures very large and confluent, color black: *excavata*, Oliv., 0.20.
  - Surface rugulose in all directions; black with front of thorax; scutellum and base of antennæ orange: *plicatula*, Fab., 0.20.
- Ribs and punctures regular and distinct:
  - Color black: *porcata*, Melsh., 0.13.
  - Color red with obscure spots: *Melsheimeri*, Crotch, 0.13.

Most of these species are widely distributed east of the Mississippi river, but a few of them, (*nigrita*, *notata*, and *plicatula*) have as yet been observed only in the Southern States.

Sub-family CASSIDIDES.

This sub-family is founded upon the genus *Cassida* of Linnaeus, a term derived apparently from the Latin *cassida—a helmet*. They are easily recognized by their rounded and usually more or less flattened form, the thorax and elytra being dilated into a broad thin margin, beneath which the head and limbs are retractile so as to be sometimes partially, but usually wholly concealed. In this respect some of them bear a close resemblance to some of the genera of scavenger beetles, such as Peltis, Thymalus and Nitidula, but from these they can be readily distinguished by their strongly dilated and deeply bilobed tarsi, and their antennæ not abruptly enlarged at the tip. They are of medium or rather large size, and are often prettily colored. A few species are extremely brilliant, resembling drops of burnished gold, but this brilliancy appears to be in some way dependent upon the vital functions, as it disappears immediately after death. The larvæ are oval, flattened, prickly grubs, feeding upon the surface of leaves, often in company with the perfect insects. Many of the foreign species feed upon thistles

[Fig. 89.]



Cassida bivittata, Say.—2, larva; 3, pupa; 4, beetle—after Riley.

and other plants of the composite family, but most of the American species are found on different species of convolvulus, especially the morning-glory and the sweet-potatoe, both of which belong to this genus of plants. The leaves of these plants are often riddled with holes, and seriously injured by these insects.

It is in this family that the habit of the larvæ of covering themselves with their own excrement is most conspicuous and universal. Other larvæ *(Crioceris* and *Blepharida)*, which have this habit, void their excrement directly upon their backs, but the larvæ of Cassida support their excrement on a long forked process which issues from the body just above the anal aperture, and is directed forwards over the body like a parasol. The object of this singular habit is supposed to be to protect the insects either from birds and other natural enemies, or from the direct rays of the sun. The former is probably the true explanation. That it can not be the latter, seems to be proved by the practice of most of these larvæ of feeding upon the under side of the leaves where the direct rays of the sun cannot reach them. Mr. Riley has stated this to be the habit of the larvæ of many of the Cassidides, and I have observed the same to be true of the larvæ of Blepharida rhois.

The Cassidides present four well marked genera as follows:

A. Head prominent, visible; size below medium; color blue .... PORPHYRASPIS.
A A. Head partially visible; prosternum advanced; size large; red spotted with black.. CHELYMORPHA.
A A A. Head completely concealed.
  B. Body oblong oval, convex; size large; color dull greenish brown .... PHYSONOTA.
  B B. Body oval or orbicular, moderately convex or depressed; size about medium; colors various .... CASSIDA.

Porphyraspis, Boheman, meaning a *purple shield*, is founded upon the *Cassida cyanea* of Say, found in the Southern States. *Chelymorpha*, Chev., signifies literally *tortoise shape*. It has for its type the *C. cassidea*, Fabr., subsequently named *cribraria*, by the same author. It is also the *C. argus* of Herbst. It is about four-tenths of an inch long, of an oblong oval, convex form, brick-red, with four or six black dots on the thorax, and six on each elytron. The larva is said to feed upon the milkweed. *Physonota*, Boh., meaning *swollen* or *convex back*, contains the *P. unipunctata*, Say, of about the same form and size as the preceding species, but the head is completely hidden under the anterior margin of the thorax. It is of a dull greenish or yellowish-brown color, with one, three, or five black dots on the thorax. *Cassida* has been divided into two sub-genera, *Cassida* proper having the antennæ not longer than the thorax, and usually of a sub-convex, oval form; and *Coptocycla*, with the antennæ longer than the thorax, and usually of an orbicular and depressed form. The species which occur in this section of country may be tabulated as follows:

Cassida proper.

nigripes, Oliv.; length one-fourth inch or less; dull red, with three obscure black dots on each elytron, in a triangle; puncto-striate. The *pallida*, Herbst, is probably a pale variety of this.

bivittata, Say; length two-tenth inch; thorax dull red; elytra yellow, with a black suture and two black stripes on each; puncto-striate.

thoracica, Boh.; length three-tenth inch; pale green, region of the scutellum obscure brownish; irregularly punctate.

Coptocycla.

aurichalcea, Fab.; length less than one-fourth inch; golden yellow, pale yellow after death, puncto-striate.

clavata, Fab.; length more than one-fourth inch; uneven, dark brown; margin of thorax and middle and tip of margin of elytra, pale transparent.

guttata, Oliv.; length less than one-fourth inch; varying from pale brown to blackish brown, sometimes spotted with yellow; the whole margin, except the shoulders of elytra, pale transparent.

purpurata, Boh.; less than one-fourth inch; brownish red with a lateral triangular transparent patch; rare.

Section IV. *TRIMERA.*

Apparently three joints in all the tarsi, except the Erotylidæ, which have four or five; the joints dilated and brush-like beneath, with the penultimate usually bilobed.

This, like the other primary sections of the Coleoptera, is based upon the apparent number of joints in the tarsi. We have stated in the introductory part of this treatise that the highest, and what may therefore be called the normal or typical number of joints in the feet of the Coleoptera, is five, and that whenever there appears to be a lesser number the rudiments of the deficient joints, or a part of them, can usually be detected by close inspection. The present, or *trimerous* section, is less perfect or more exceptional in proportion to the number of the species, than any of the preceding sections, that is to say, a considerable number of genera and species which require to be associated with the trimerous beetles in consideration of their general structure, have four distinct joints in their tarsi, besides the indistinct rudiment of the missing and penultimate joint.

The antennæ are almost always clubbed at the end and the tarsi are dilated, bilobed, and with a brush of hairs on the under side. The first of these characters allies them to the club-horned scavengers and distinguishes them from the Chrysomelidæ, whilst the latter character allies them to the last named family and at the same time distinguishes them from the Clavicornes proper. The great majority of them are remarkable for the very wide terminal joint of the maxillary palpi. They are almost always of small or moderate size.

This section is much smaller than the others, and contains but two tribes, which bear but little resemblance to each other in form, and are wholly unlike in their habits.

Tribe 1st (or 20th). Trimerous fungus-beetles. *Trimera fungivora.* BOLITOPHAGA.

Body oval or oblong; antennæ exposed and often nearly or quite as long as the head and thorax; colors red and black, usually combined; habits fungivorous. Families: Erotylidæ, Endomychidæ.

Tribe 2d (or 21st). Plant-louse eating beetles. *Trimera carnivora.* APHIDIPHAGA, Latreille.

Body hemispherical; antennæ very short and usually concealed beneath the margin of the thorax; elytra usually red with black dots, sometimes the reverse; feed upon plant-lice. Family: Coccinellidæ.

TRIBE XX.

TRIMEROUS FUNGUS-BEETLES.

Trimera fungivora. BOLITOPHAGA.

This is a tribe of moderate extent, and is composed of the families Erotylidæ and Endomychidæ. The former were designated by Latreille by the name *Clavipalpi*, on account of the large half-moon shaped joint with which the maxillary palpi are usually terminated, and were placed by him in the tetramerous section in deference to the tarsal system of classification, inasmuch as four distinct joints are usually present in the tarsi, besides the rudimental penultimate joint. But their general resemblance to the Endomychidæ in size, color and habits, as well as in several important organic characters, has induced all recent systematists to place the two families in the same general division. It is a much more difficult question to decide whether these insects should be retained as a distinct tribe near the end of the order, between the Chrysomelidæ and the Coccinellidæ, or be merged in the extensive series of club-horned scavengers, or Clavicornes proper, with which they agree in their clavate antennæ, and also with some of them in their fungivorous habits. Mr. Westwood, whilst he retains them in the former position, expresses a doubt whether they should not be placed in the necrophagous or scavenger series, as Mr. Stephens previously, and Mr. Thomson more recently has done; and Mr. Crotch, in his recent revision of these families, expresses the opinion that the Erotylidæ should immediately follow Cryptophagidæ, and that the Endomychidæ should succeed the Mycetophagidæ. Other authors, whilst leaving the families in general undisturbed, have contented themselves with removing from them certain genera, which are usually associated with them; Mr. MacLeay, for example, having removed Languria to the family of Engidæ, corresponding nearly to our two families of Trogositidæ and Cucujidæ, whilst Mr. Stephens has placed Tritoma in the family of Anisotomidæ. If the number of joints in the tarsi were the only character which distinguishes these tribes, their separation, probably, would never have taken place, since, as we have seen, the number of these joints is subject to much variation in the smaller species of Clavicornes. But a much more important distinctive character is the structvre of the tarsal joints; being dilated, evenly cushioned beneath, and with the penultimate joint often deeply bilobed, thus allying them to the Phytophaga, whilst it separates them from the pentamerous Clavicornes, which, though they usually have the tarsi more or less garnished with hairs, never, we believe, exhibit the dense and even brush of hair-like papillæ which is so characteristic of the genuine Tetramera; and in the few instances in which any dilatation of the tarsi occurs among the Clavicornes, it is small in extent and limited to the anterior feet of the males, being a sexual distinction. It is also worthy of note that the important and rudimental joints in the present tribe are uniformly the penultimate, as in the tetramerous section, whilst in the imperfectly developed tarsi of the small pentamera, it is usually the first, or first and second joints that are deficient.

The characters of the few known larvæ of this tribe do not afford any clear indications of their systematic position; for whilst the larva first described by Fischer and copied by Westwood, and supposed to be that of Tritoma, strikingly resembles the larvæ of the Chrysomelidæ in its thick fleshy and spotted body, the larva of Triplax, figured by the last named author, bears, as he remarks, a strong resemblance to that of the genus Colydium, which we have placed in our aberrant group of *Subclavicornes*; and the larvæ of Endomychus have been compared both to those of Silpha and Lampyris. Thus it appears that the position of these families, separate and remote from the pentamerous Clavicornes, first assigned to them by Latreille, rests upon strong considerations; and we may add that Lacordaire, one of the latest and highest authorities upon the classification of this order, has virtually given his sanction to this arrangement. For though his work had not reached the trimerous section, at the time of his death, it is evident, from his not including them in the pentamerous series, that he had reserved them for this position.

It is worthy of remark that the dilated and cushioned tarsi of these insects would seem to indicate a decided diversity of habit as compared with other fungus beetles which have simple tarsi. The most obvious explanation is that this structure of the feet enables them to adhere to the smooth surface of the boleti upon which they deposit their eggs and in which their larvæ reside, whilst those beetles which subsist mostly upon the fungi which grow beneath the bark of decaying trees, require no such provision.

The following table gives the principal distinctive characters of the two families of this tribe:

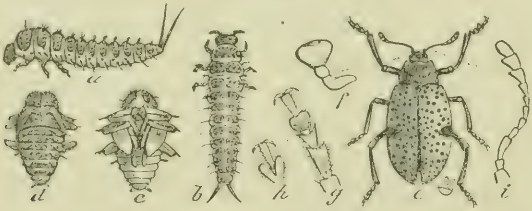
A. Tarsi apparently 4-jointed, sometimes 5-jointed; antennæ usually shorter than the head and thorax, and with a club of from three to six joints; maxillary palpi usually terminated by a wide securiform joint. Thorax convex: Erotylidæ.

A A. Tarsi apparently 3-jointed, sometimes 4-jointed. Antennæ usually as long as the head and thorax, or longer, with the two or three terminal joints slightly enlarged; maxillary palpi nearly cylindrical, labials sometimes enlarged at the end. Thorax usually with three depressions at the base, and with a wide lateral margin.................................... Endomychidæ.

Family LXII. EROTYLIDÆ.

This is a family of moderate extent founded upon the genus *Erotylus*, of Fabricius, a term borrowed directly from the Greek, and meaning *friendly* or *pleasing*—probably in allusion to the contrasted colors of many of the species. They are of moderate or small size, only a few species of Dacne and Erotylus proper attaining to half an inch in length, whilst the great majority are less than a quarter. The most common coloration is a red thorax with black, or black and red elytra, or the reverse; but some species are unicolorous.

[Fig. 90.]



Cypherotylus Boisduvali, Chev.:—*a*, *b*, larva, side and back views; *c*, *d*, pupa, under and upper sides; *e*, beetle, natural size; *i*, antenna; *j*, palpus; *g*, tarsus from below; *h*, terminal joint of same from above—after Riley.

The leading characters have been given in the preceding table and in the general description of the tribe. We will only repeat here that the two principal characters by which they are distinguished from other fungus-eating beetles are their widened tarsi, covered beneath with a dense brush of hair-like papillæ, with the last joint but one usually bilobed, and the form of the terminal joint of the maxillary palpi—which with a few exceptions is broadly triangular, whilst the pentamerous and heteromerous fungivorous beetles have slender tarsi, at most loosely haired on the under side, and the palpi of the same width throughout, or, in some of the Diaperidæ, a little widened at the end. These insects usually inhabit the fungi which grow upon trees, but we have found several species of Languria upon flowers, especially the umbellifera.

A. Body elongate and parallel; club of antennæ 5 or 6-jointed; tarsi 4-jointed; palpi not dilated, eyes finely granulated........Languria
A A. Body oval; club of antennæ 3-jointed, rarely 4-jointed.
  B. Tarsi 5 jointed; palpi not dilated; form oblong oval........Dacne.
  B B. Tarsi 4-jointed; 3d joint of maxillary palpi strongly dilated; form oval or short oval.
    C. Eyes large and coarsely granulated........Ischyrus.
    C C. Eyes moderate, finely granulated; size small........Triplax.

Languria, Latr., contains about a dozen N. A. species. The most common is the *L. bicolor*, Fab., upwards of a third of an inch in length, blue-black except the thorax, which is dull-red with a black spot on the middle. The *L. Mozardi*, Latr., is similar but smaller; the elytra have a greenish tint, the antennæ and thighs are reddish at base, and the thorax is without the black spot on the disk. *Dacne*, Latr., contains five species of very unequal size. The name is derived from the Greek *dakno—to corrode.* The *Dacne heros*, of Say, is two-thirds of an inch in length or upwards, black with two broad, dull-red bands across the elytra. The *D. fasciata*, Fab., is similar, but only about half an inch long, and the bands are of a lighter and brighter color. The *D. 4-maculata*, Say, is only about one-tenth of an inch long, black, with two red spots on each elytron. *Ischyrus*, Lacord.,—a term meaning *robust*—contains three species, the largest of which, the *I. 4-punctatus*, Oliv., is not uncommon. It is about a third of an inch long, light orange-red varied with black, and with a transverse series of four black dots on the thorax.

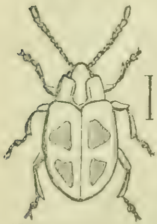
The genus *Triplax*, of Paykull,—a term meaning *three-fold*, in allusion probably to the three-jointed club of the antennæ—is much more numerous in species than the others. Mr. Crotch enumerates eighteen species, a part of which he has placed separately under the generic term *Cyrtotriplax*—the prefix meaning *convex*—on account of their short ovate form, and the body not strongly punctured beneath. This distinction had already been made by Fabricius, who gave to those short convex species the name *Tritoma*, which seems to have been abandoned on account of its confused synonomy. The species of Triplax are all small, being between one-eighth and two-tenths of an inch in length, and variegated with black and red. *Cypherotylus*, Cr., contains a single large and striking species, the *Boisduvali*, Chev. (Fig. 90), tolerably common in the Rocky mountain region of Colorado, where Mr. Riley has found its larva feeding on tree-fungi.

Some of the species indicated are closely allied and are perhaps only varieties.

Family LXIII. ENDOMYCHIDÆ.

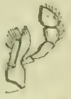
This is a family of small extent, named from the genus *Endomychus*, Paykull, a name derived from the Greek *endon—within*; and *muchos—a concealed place*—probably referring to the concealed habitations of these

[Fig. 91.]



ENDOMYCHUS:—After Rye.

[Fig. 92.]



Maxillary palpus of ENDOMYCHUS.

insects and their larvæ in the substance of boteli or tree-fungi. The most remarkable character of this family, as compared with the Coleoptera in general, is the diminution in the number of the joints of the tarsi, but three joints being visible even in species of considerable size, with a scarcely perceptible rudiment of another joint at the base of the last; all the joints except the last being dilated and cushioned beneath, and the second joint deeply bilobed. The antennæ are usually longer than the head and thorax combined, and with the two or three last joints slightly enlarged. The thorax is almost square, and in most of the genera has a wide thin margin, which is slightly turned upwards at the sides.

A. Tarsi 3-jointed. Length from one to two-sixths of an inch.
  B. Palpi clavate, thorax a little wider behind; antennal club of three equal joints...ENDOMYCHUS.
  B B. Palpi cylindrical; thorax a little narrower behind; antennal club indistinct, the last joint somewhat dilated and compressed..........LYCOPERDINA.
A A. Tarsi 4 or 5-jointed. Length less than one-sixth of an inch.
  C. Thorax about square; tarsi 4-jointed.
    D. Anterior coxæ contiguous..........RHANIS.
    D D. Coxæ separated by the prosternum; antennal club enormously dilated in the males: PHYMAPHORA
  C C. Thorax wider than long; size very small.
    E. Antennæ 11-jointed; form oval; body hairy..........MYCETÆA.
    E E. Antennæ 10-jointed; form globose; tarsi 5-jointed..........ALEXIA.

Endomychus proper contains but one N. A. species which closely resembles the *E. coccineus* of Europe. It is the *E. biguttatus*, Say—one-sixth of an inch long, black, with the elytra bright-red, with two black spots on each, the larger one near the tip. *Lycoperdina*, Latr., derived from *Lycoperdon*, a genus of fungi—contains many species which have been divided into several genera, or sub-genera, by more recent authors. The most common species is the *L. vitatta*, Fab., (or *lineata*, Olivier;) a quarter of an inch long, with three broad stripes on the elytra, the middle one being common to both. The *L. ferruginea*, LeC., is a little smaller, of a piceous or reddish-black color, with the head, legs and margins of the thorax and elytra brownish-red. The other genera contain but one or two species each. The two last genera are anomalous, and do not strictly belong in this family.

TRIBE XXI.

PLANT-LOUSE BEETLES.

Trimera carnivora. APHIDIPAGA, Latreille.

The rounded or hemispherical form of these insects, commonly known by the name of lady-birds, and their dotted coloration, render them one of the most easily recognized of all the families of Coleoptera. Their three-jointed tarsi, and the broad hatchet-shaped terminal joint of the maxillary palpi, are their most distinctive organic characters. The tarsal joints are always dilated and cushioned beneath, and the second joint is deeply bilobed.

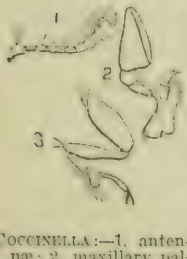
These insects seem to be specially appropriated to keeping in check the extensive families of plant-lice, both the leaf-lice (*Aphides*), and the bark-lice (*Coccides*), upon which they feed voraciously, in both the imago and the larva states; and they are also known to devour the eggs of other insects. Mr. Westwood refers to some observations which go to show that they must sometimes subsist upon vegetable food, and I have seen the *Coccinella* 15-*punctata*, Oliv., with its head deeply immersed in a ripe raspberry, implying that they sometimes feed upon the juices of ripe and succulent fruits; but such cases are rare and exceptional to their general habits. It is not uncommon to find branches of trees thickly covered with the scales of bark-lice, almost every one of which has been torn open and its occupant destroyed by these predaceous insects.

The larvæ are oblong, blackish grubs, and are usually thickly beset with spines, which are also furnished with smaller spines or prickles, giving them, when magnified, a formidable appearance. These, as is the case with other larvæ, are much more voracious than the perfect insects. When about to pupate they suspend themselves by the tail to a leaf or branch, and either push the larval skin upwards, where it remains shrivelled about the point of attachment, or remain within it till they emerge in the beetle form, when it bursts open upon the back and permits the enclosed insect to escape. This tribe of beetles is composed of the single family of Coccinellidæ.

Family LXIV. COCCINELLIDÆ.

As this family is co-extensive with the tribe to which it belongs, we have only, in treating of it, to refer back to the remarks already made. In a systematic point of view the Coccinellidæ occupy a remarkably anomalous and isolated position, in consequence of the apparent heterogeneousness of their organic characters. Whilst having the rounded form of the plant-beetles, the clavate antennæ of the scavengers, and the dilated palpi of the fungus-beetles, they agree in food and habits with none of these, but resemble, in their predaceous habits, the pentamerous ground-beetles, and the soft winged carnivora, all of which have their bodies more or less elongated, their antennæ filiform, and their palpi slender or but moderately dilated. Moreover, the reduction in the number of their tarsal

[Fig. 93.]



COCCINELLA:—1, antennæ; 2, maxillary palpus; 3, tarsus—after Westwood.

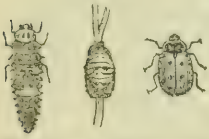
joints evidently places them at the extreme end of the order, whilst their predaceous habits ally them to the pentamerous carnivora which occupy the first rank in the perfection of their organization.

The name Coccinella is derived from the Coccus which produces the cochineal dye, and was suggested by the prevalence of bright red in the coloration of these insects.

A. Antennæ nearly as long as the head and thorax; elytra almost always red dotted with black; length more than a sixth of an inch.
  B. Body somewhat oblong; anterior margin of the thorax nearly or quite straight....HIPPODAMIA.
  B B. Body hemispherical; anterior margin of the thorax more or less concave.........COCCINELLA.
A A. Antennæ usually very short; elytra never red; length almost always less than a sixth of an inch.
  C. Thorax deeply hollowed in front so as to embrace the head; color black, usually dotted or varied with red or white.
    D. Surface glabrous; black, dotted with red, or whitish.
      E. Margin of elytra wide and entire; size various..............................CHILOCORUS.
      E E. Margin of elytra narrow and pitted, for the reception of the tips of the thighs; size small..............................HYPERASPIS.
    D D. Surface pubescent; black, sometimes varied or tipt with red..................SCYMNUS.
  C C. Anterior margin of thorax nearly straight.
    F. Margin of elytra entire; prosternum not advanced; color white with black dots: PSYLLOBORA.
    F F. Margin of elytra pitted; prosternum advanced so as to conceal the mouth; color black without spots; size minute..............................ŒNEIS.

Hippodamia, Chev., has for its type the *H. maculata*, of DeGeer, the most common of all our Coccinellidæ; nearly a quarter of an inch in length; scarlet-red with six large black dots on each elytron, two of which join those on the other elytron at the suture. About fifteen other species have been indicated, most of which exhibit a tendency to follow this type of coloration. Upwards of twenty N. A. species of *Coccinella*, Linn., have been described and distributed in a number of sub-genera, founded for the most part upon obscure or unimportant characters. *Chilocorus*, Leach, contains the common *C. bivulnerus*, Muls., two-tenths of an inch long, black, with a red dot on the middle of each wing-cover, so useful in destroying the bark-lice of the apple tree, and of the pine leaf. The *C.* (*Exochomus*, Redt.) *tripustulatus*, DeG., is similar but larger, with a red spot on each shoulder, and a spot on the suture behind the middle. *Hyperaspis*, Redt., meaning literally *covered by a shield*, contains many species readily distinguished by their small size and their black color, dotted with red, or whitish. *Brachyacantha*, Muls., differs from Hyperaspis only in the presence of a minute spine on the outer margin of the anterior tibiæ.*

[Fig. 94.]



HIPPODAMIA CONVERGENS:—Larva, pupa and beetle—after Riley.

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* The separation of *Megilla* and *Ceratomegilla* from *Hippodamia*; of *Mysia* and *Cycloneda* from *Coccinella*; of *Exochomus* from *Chilochorus*; and of *Brachyacantha* from *Hyperaspis*, under distinct generic names, are examples of the modern tendency to the excessive multiplication of genera, often founded upon the most trivial characters.

Scymnus, Herbst, contains a considerable number of very small black species, easily recognized by their downy surface, and the usually tawny tips of the elytra, or margins of the thorax, characters which appear to have suggested the generic name, which literally means a *young lion*: a name, however, which had already been given by Cuvier to a genus of fishes of the shark family. *Pysllobora*, Chev., contains the *P. 20-maculata*, Say, a little species a tenth of an inch or less in length, readily distinguished from all our other Coccinellidæ by its white color densely sprinkled with black dots. Two other and similar species have been described, which perhaps are only varieties. *Œneis*, Mulsant, is represented by the minute *Œ. pusilla*, LeC., only a fifteenth of an inch in length, almost globular in form, and of a shining black color. The male has the head, sides of thorax and legs yellow.

CATALOGUE OF THE PRINCIPAL AUTHORS

Who have written upon the Coleoptera, with special reference to the describers of N. American species, or of their Natural History, and with the ordinary abbreviations of their names prefixed.

Aub. Dr. Charles Aube, a French entomologist; author of a general work upon the water-beetles, and of a Monograph of the Pselaphidæ, 1834, and a Revision of the same, 1844.

Aud. Jean Victor Audouin, M. D., Librarian to the Institute of France, and one of the Curators of the Jardin du Roi. An eminent French naturalist and comparative anatomist. Author of many works from 1818 to 1830. Some of his most valuable writings are his Memoires upon the anatomy and physiology of Insects and other Articulata.

Beauv. or Pal de B. Palisot, Baron de Beauvois, a French entomologist. Author of a descriptive work upon insects collected in Africa and in America—1805 and subsequently.

Blanch. Emile Blanchard, author of a Catalogue of the Entomological Collection in the Museum of Nat. History of Paris, 1850, and of a large illustrated work upon the Metamorphoses of Insects.

Bland. James H. B. Bland, describer of a number of N. A. Coleoptera in the Proceedings of the Ent. Soc. of Philadelphia.

Boh. C. H. Boheman, author of a Monograph of the Cassididæ—1850-62—and descriptions of New Species of Coleoptera. N. Mem., Natur., Moscow.

Bon. Francisco Bonelli, professor of Zoology at Turin. An Italian Naturalist. His principal entomological work was a Memoir upon the Carabidæ. 1811.

Brend. Emil Brendel, M. D., of Peoria, Illinois. Author of several papers upon the Pselaphidæ, with descriptions of new species, in the Proceedings of the Ent. Soc. of Philadelphia, 1865-66.

Burm. H. Burmeister, a learned German entomologist. His principal work is the Handbook of Entomology, in 6 vols., 8-vo, 1832-47. The elementary part of this work has been translated into English by W. E. Shukard, 1 vol., 8-vo, 654 pages, London, 1836.

Chaud. Baron M. de Chaudoir, a Russian entomologist. Author of several memoirs upon the Caribidæ, in which a number of N. American species are described. 1842-7.

Chev. A. Chevrolat, a French entomologist. Author of the Coleoptera of Mexico, and other writings upon the insects of this order.

Crotch, G. R., Cambridge. Mass. Author of Synopsis of the Dytiscidæ, Chrysomelidæ, Erotylidæ Endomychidæ and Coccinellidæ of the U. S., published in the Proc. Acad. Nat. Sciences, of Philadelphia, and in the Trans. Am. Ent. Society, 1873; and of a Check List of N A. Coleoptera, 1874.

Dalm. John Wm. Dalman, director of the museum at Stockholm. Author of various works upon different orders of insects. 1823-6.

Deg. Baron Charles DeGeer, marshal of the Court of the Queen of Sweden, born 1720, died 1778. Author of a History of Insects, in 7 vols., 4-to, with plates, 1752-78. A work replete with accurate details of the habits of insects, and forming a fit sequel to the similar work of Reaumur, the last volume of which was published ten years before the work of DeGeer was commenced.

Dej. Count Dejean, peer of France and lieut.-general in the French army. Author of a catalogue of the Coleoptera in his own extensive collection; and of a general descriptive work in several volumes, from 1825 to 1831, which contains descriptions of many N. American species.

Drur. Drury, an English goldsmith. Author of a finely illustrated work, in 3 vols., 4-to, containing upwards of six hundred and fifty colored figures of the rarer insects in his own cabinet, amongst which are many American species. 1770-82. Enlarged by Mr. Westwood in 1837.

DUF. Leon Dufour, a French physician and comparative anatomist. One of the principal authorities upon the internal structure of insects.

DUM. Constant Dumeril, professor to the Faculty of Medicine and to the Jardin du Roi. An eminent French naturalist and comparative anatomist; born at Amiens, 1774. Author of many works in different departments of natural history, among which was a work entitled General Considerations upon the Class of Insects. His works date from 1806 to 1830.

ER. or ERICHS. William F. Erichson, of Berlin, in Prussia, lately deceased, one of the ablest writers of recent times upon the Coleoptera. His works are written in the German language. There is another author of the same name, G. F. Erichson, also of Berlin, author of the genera and species of the Staphylinidæ.

ESCH. Friedrich Eschscholtz, a Prussian entomologist. Author of a zoological atlas, 1829, and a work entitled Entomographien, in the German language.

FAB or FABR. John Christian Fabricius, professor of natural history at Kiel, in Denmark. A pupil of Linnæus, and one of the most eminent and voluminous writers upon insects; born 1742, died 1807. Author of many works, and the original describer of a large proportion of the American insects known at that time.

FISCH. Gotthelf Fischer de Waldheim, director of the imperial museum at Moscow, Russia. Author of numerous works, from 1801 to 1824. His principal work was the Entomography of the Russian Empire, in 2 vols., 4-to, with splendid engravings. 1820-22.

FITCH. Asa Fitch, M. D., entomologist to the Agricultural Society of New York. Author of thirteen annual reports upon insects of New York, chiefly those injurious to agriculture. First report published in 1856. Dr. Fitch's writings have contributed greatly to the dissemination of useful information upon the injurious insects of the United States.

FORST. Dr. John Reinhold Forster. Author of a description of a Hundred New Species of Insects, London, 1771, among which were a few N. American Coleoptera.

GEOFF. M. Geoffroy, a celebrated French physician and entomologist. Author of an Abridged History of Insects, 2 vols., 8-vo, with plates, 1764, and of a Description of the Insects in the Environs of Paris. Many genera of Coleoptera were first defined in these works.

GLOVER. Townend Glover, entomologist to the Department of Agriculture, at Washington. Author of numerous brief monthly reports upon injurious insects, and of an extensive series of plates, illustrative of North American insects in all the orders, but of which only those appertaining to the Orthoptera have yet been published.

GM. or GERM. E. Francis Germar, professor of mineralogy at Halle, in Prussian Saxony. Editor of the "Magazin der Entomologie," 4 vols., 8-vo, 1813-21, and of the "Insectorum Species Novæ," 1 vol., 1824—an accurate describer of many genera and species of Coleoptera.

GRAV. J. L. C Gravenhorst, a German entomologist. Author of a Monograph of the Staphylinidæ, 1806, and of a Nosology of the genus Ichneumon, 1814—a standard authority upon these two families of insects.

GUER. M. Guerin-Meneville, a distinguished French entomologist Author of Species and Genera of the Articulated Animals, 1843 and subsequently; and editor of the Magazine of Zoology, and of the Zoological Review.

GYLL. L. Gyllenhal, a Swedish naturalist. An original describer of some of the genera which contain American species. Author of "Insecta Suecica," 1827.

HALD. S. S. Haldeman, an American naturalist. Author of a large number of memoirs in various branches of natural history, and original describer of many N. American Coleoptera, mostly between the years 1842 and 1852.

HARR. Thaddeus Wm. Harris, M. D., librarian of Harvard University, in Cambridge, Massachusetts, a distinguished American entomologist. Author of a Treatise on Insects injurious to Vegetation, 1st edition 1852, 2nd ed. 1862, and author of many other valuable contributions to American entomology; born 1795, died 1856. It is a matter of lasting regret that the exacting requirements of his office of librarian prevented Dr. Harris from giving to the world, in a connected and systematic form, the results of his long and enthusiastic study of insects in all their orders.

HENTZ. N. M. Hentz, professor at Chapel Hill University, North Carolina. Author of a Monograph of the Spiders of the United States, published in the 21st volume of the American Journal of Science, 1833, and describer of a number of N. American Coleoptera.

HBST. J. F. W. Herbst, originally a preacher at Berlin, Prussia, born 1743. A voluminous writer upon insects. One work, in 10 volumes was devoted wholly to the Coleoptera, 1785 to 1806. Another of his works is a Monograph of the genus Papilio. All his works were illustrated by colored plates.

HOFFMG. Count Hoffmansegg, a learned naturalist of Saxony, and a zealous patron of the sciences. Author of various memoirs in Illiger's Magazine and elsewhere.

Hope. Rev. F. W. Hope, an English entomologist, possessor of a fine cabinet of insects. Author of the Coleopterist's Manual, 1837. Most of his original descriptions are in the family of Lamellicorn beetles.

Horn. George H. Horn, M. D., of Philadelphia. Author of a Revision of the Tenebrionidæ of America, north of Mexico, 1870, and of Synopses of the Histeridæ and Bruchidæ of the U. S., 1873, and other memoirs upon N. American Coleoptera.

Illig. I. C. G. Illiger, professor at Berlin, an eminent naturalist, second only to Linnæus in the felicity and elegance of his nomenclature. Though he died in middle life, his works extended to 13 vols., 8-vo, embracing all departments of natural history. His most extensive work is his Magazine of Entomology, in 7 vols., 8-vo, 1801-1807

Kirb. Rev. Wm. Kirby, rector of Barham, England, an eminent English entomologist. Author of various works upon different orders of insects. His most important work was an Introduction to Entomology, in 4 vols., 8-vo., by Wm. Kirby and Wm. Spence, 1st edition in 1815. This was for many years the principal elementary work upon insects in the English language. Mr. Kirby was also author of that part of the Fauna Boreali-Americana which treats of insects, 1 vol., 4-to, 1837, in which many N. American insects, chiefly Coleoptera, are described.

Knoch. A. G. Knoch, a German entomologist. Author of the Neue Beitræge zur Insectenkunde, 1 vol., 8-vo, 1801.

Lacord. Theodore Lacordaire, professor of zoology and comparative anatomy in the University of Liege, and chevalier of the Order of Leopold. A very eminent French naturalist and entomologist, recently deceased. His works extend over a period of upwards of forty years, among which was an Introduction to Entomology, published as a part of the Suites a Buffon, 2 vols., 8-vo, 1834-38. But the crowning work of his life was the Genera des Coleoptères, in 10 vols., 8-vo, the last volume of which was not completed at the time of the author's death, on the 18th of July, 1870.

Laf. M. de LaFerte-Senecterre, a French entomologist. Author of an elaborate monograph of Anthicus and allied genera, 1848.

Lap. F. L. de Laporte, a French entomologist. Author of Etudes Entomologiques, 1835, and other works; original describer of a number of genera and species of N. A. Coleoptera.

Lat. or **Latr.** Pierre Andre Latreille, professor of the museum of natural history, in Paris; born at Brives, France, in 1762. A very eminent French naturalist, sometimes styled the prince of entomologists. The genius of this celebrated author illuminated every department of the science of entomology, embracing all the classes of articulated animals. His labors extended through a period of about thirty years. The first of his numerous publications bears the date of 1800. His three principal works are: a Natural History of Crustacea and Insects, 6 vols., 8-vo, 1802-5; Genera of Crustacea and Insects, 4 vols., 8-vo, 1806-7; and the department of Crustacea, Arachnida and Insects, in Cuvier's Animal Kingdom, 2d edit., 1828.

Leach. W. E. Leach, an English physician and naturalist, one of the curators of the British museum. Author of numerous memoirs upon all the classes of the Articulata, and editor of the Zoological Miscellany, 3 vols., 8-vo, 1817.

LeC.. John L. LeConte, M. D., of Philadelphia—the principal American authority upon North-American Coleoptera. Author of a classification of the Coleoptera of North America, 1 vol. 8vo. 1861–1873; and of many articles upon the different families of Coleoptera, from 1844 to the present time; and original describer of a large proportion of the North American species in this order of insects. Dr. LeConte's father, Major John LeConte, was also a zealous entomologist, joint author with Boisduval of a General History of North American Lepidoptera and their Caterpillars, of which but one volume was published, in Paris, 1833; and author of a monograph of North American Histeridæ, in the Boston Journal of Natural History, 1845.

Linn. Charles de Linne, usually written in the Latinized form of Linnæus. Professor of Natural History at Upsal, in Sweden. Born in 1707, died 1778. One of the most eminent of naturalists, and founder of the modern system of nomenclature, both in Natural History and Botany. His name is stamped upon almost every page in the nomenclature of plants and of every department of animated nature. He was the author of nineteen distinct works, the principal of which were the "Species Plantarum," and the "Systema Naturæ." First edition 1735; 13th edit. 7 vols 8vo. 1788.

MacL. W. S. MacLeay, an English entomologist, a learned and philosophical writer upon insects and their classification. Author of the Horæ Entomologicæ, 1 vol. 8vo. 1819, and other works.

Mann. C. G. Mannerheim, Counsellor to the Emperor of Russia. Author of a monograph of the Euconemidæ, 1823, and of a New Classification of the Staphylinidæ, 1830, and of several memoirs in the Bulletin of the Imperial Society of Naturalists of Moscow, in which species from Sitka and California are described, 1843–46.

Mars. S. A. de Marseul, a French Entomologist. Author of an elaborate monograph of the Histeridæ, 1853–1860; and of a catalogue of the Coleoptera of Europe, 1866.

MELSH. Friedrich Ernst Melsheimer, M. D., a zealous contributor to American Entomology; died recently at Davidsburg, in Pennsylvania, March 10, 1873, at the advanced age of nearly ninety-one years. Author of the first general catalogue of Coleoptera published in the United States, 1806, which was revised and enlarged by LeConte and Haldeman in 1853. Also, author of many papers in the 2d and 3d volumes of the Proceedings of the Acad. of Nat. Sciences of Philadelphia, in which upwards of four hundred and fifty species of N. A. Coleoptera were first described. His father, Rev. E. F. Melsheimer, was also an enthusiastic entomologist and a co-laborer with Thomas Say, the founder of descriptive entomology in the U. S.

MOTS. Victor de Motschulsky, a Russian entomologist. Author of Etudes Entomologiques, 2 vols. 8vo. 1853-61; and of a work on the Coleoptera of Siberia.

MULS. E. Mulsant, a French entomologist. Author of a monograph of the Coccinellidæ, 1850, and other works.

NEWM. Edward Newman, an English entomologist. Author of a Grammar of Entomology, 1835; and of an Illustrated Natural History of British Moths, 1869, and editor of the Entomological Magazine, in which a considerable number of American Coleoptera are described.

OLIV. Antoine G. Olivier, Professor of Zoology to the Veterinary School of Alfort, in France, born 1756, died 1814, a distinguished French naturalist Author of a Natural History of Insects, 5 vols. folio with colored plates, confined to the Coleoptera, 1789-1808; also of the department of insects in the Encyclopedie Methodique, 5 volumes, and other works; the original describer of many North American Coleoptera.

PACK. A. S. Packard, Jr., M. D., of Salem, Massachusetts. Author of a Guide to the Study of Insects, 1 vol. 8vo. 715 pages. 1st edition 1869, 3d ed. 1873; and author of various papers upon North American insects in the different orders.

PANZ. G. W. F. Panzer, a physician of Nuremberg, and a learned entomologist, born in 1755. Author of various works upon different orders of insects, published between the years 1796 and 1813; useful works of reference at the present day on account of the accuracy of the colored figures.

PAYK. Gustavus Paykull, counsellor to the King of Sweden, an able and accurate entomologist. Author of a Fauna of Sweden, 3 vols. 8vo. 1800, confined to the Coleoptera, and author of various memoirs upon insects, and also upon birds.

PECK. William Peck, Professor of Botany in Harvard University. Prof. Peck was the author of several papers upon the natural history of certain species of injurious beetles and other insects in the Mass. Agric. Repository and Journal, 1819, and elsewhere.

PUTZ. J. Putzeys, a French entomologist. Author of a monograph of Clivina and allied genera, 1846, and other memoirs.

RAND. John W. Randall, author of two papers on Coleoptera in the 2d volume of the Boston Journal of Natural History.

REAUM. R. A. Ferchault de Reaumur, one of the most eminent of the older French naturalists; born 1683, died 1757. His labors were directed to many different departments of science, but his most important work and that which makes his name familiar to the entomologists of the present day is his memoirs upon the Natural History of Insects, 6 vols. 4to, with plates, 1734-42. This admirable work is a treasury of interesting and accurate observations upon the natural history of insects, from which all subsequent authors have freely drawn.

RILEY. Charles V. Riley, State Entomologist of the State of Missouri. Author of a series of valuable illustrated annual reports upon insects, chiefly those injurious to vegetation. First report published in 1869; the sixth report published in 1874. Also joint editor with Mr. B. D. Walsh of the American Entomologist, 1868-69, which was continued by Mr. Riley after Mr. Walsh's death to December, 1870.

ROG. W. F. Rogers, of Philadelphia. Author of a synopsis of North American Chrysomelides, 1854; since deceased.

SAY. Thomas Say, a distinguished American naturalist, and founder of descriptive entomology in the United States; born 1787, died 1834. Author of the American Entomology, 1 vol. 8vo. illustrated by colored figures, executed by his wife; and of many descriptive memoirs upon North American insects in all the orders. These papers have been collected and edited by Dr. J. L. LeConte, in 2 vols. 8vo. 1859.

SCH. or SCHŒN. C. J. Schœnherr, a learned Swedish entomologist. Author of an extensive work on the synonyms of insects, in many volumes from 1806 to 1817. Also author of an elaborate work on the Genera and Species of the Curculionidæ, in which many American species were first described; one of the leading authorities in this extensive family.

SHIMER. Dr. Henry Shimer, of Mount Carroll, Illinois. Author of several papers upon Coleoptera and other insects, in the American Naturalist, and in the Trans. of the Am. Ent. Society.

SOL. M. Solier, a French entomologist. Author of several essays and memoirs upon the Coleoptera, published mostly in the annals of the Entomological Society of France, 1840-48.

STAL. C. Stäl, a Swedish entomologist. Author of a recent review of American Chrysomelides, in the Transactions of the Swedish Academy.

UHLER. P. R. Uhler, Assistant Librarian of the Peabody Institute, Baltimore. Author of descriptions of a few species of Coleoptera, but chiefly known as a writer upon the Hemiptera and Orthoptera.

WALSH. Benj. D. Walsh, State Entomologist of the State of Illinois, for the years 1868 and 1869. He died from a railroad accident on the 18th of November, 1869. Author of one official report, in 1868. Editor of the Practical Entomologist, 1865-67, and joint editor with Mr. C. V. Riley, of the American Entomologist, 1868-69; and author of various papers upon insects in scientific periodicals. Mr. Walsh was an able and enthusiastic entomologist.

WEB. Frederick Weber, a German naturalist, Professor at Kiel. Author of "Observationes Entomologicæ," 1 vol. 8vo. 1801. His name appears as the original describer of a small number of North American Coleoptera.

WESTW. J. O. Westwood. Prof. of Entomology in Oxford University, England; one of the most eminent entomologists of the present day. Author of many able works and memoirs upon insects in all the orders, many of which are illustrated by colored drawings. His most valuable work is the Introduction to the Modern Classification of Insects, in 2 vols. 8vo., pages 462 and 715, with 133 blocks of figures inserted in the text, each containing about twenty outline cuts, illustrating all the orders of insects and the details of their structure. This admirable work, which was published in 1839-40, is now out of print, and copies are difficult to be obtained.

ZIEGL. Rev. David Ziegler, author of descriptions of New Species of Coleoptera, in the Proceedings of the Acad. of Nat. Sciences, of Philadelphia, for the year 1844.

ZIMM. Christian Zimmerman, M. D., an able and accurate entomologist, who came to this country from Germany about the year 1832. He left many valuable notes upon the Coleoptera, in manuscript, but most of his descriptions of species have been superseded by more recent publications. Some of these papers have been recently published, with annotations, by Dr. LeConte, in the Transactions of the American Entomological Society, for the year 1868.

GLOSSARY,

OR DEFINITION OF THE TERMS MOST COMMONLY USED IN DESCRIBING INSECTS.

Abbreviated, shortened; not reaching the end of a given part,

Abdomen, the hindermost division of the body. See page 14.

Abnormal, irregular, exceptional.

Abrupt, sudden, not gradual.

Acicular, needle-shaped.

Aculeate, prickly.

Acute, sharp-pointed.

Adephagous, ravenous, predaceous.

Annulate, furnished with rings.

Antenna, (plural *antennæ*), appendages to the head, commonly called the horns. See page 10.

Apex, the terminal point.

Approximate, near to, or near together.

Apterous, without wings.

Articulate, divided into joints.

Attenuated, tapering.

Base, the part furthest from the apex; the base of the thorax is the part where it joins the elytra

Bifid, cleft; cloven in two.

Bilobate, divided into two lobes.

Capitate, terminating in a little head or knob.

Carinate, furnished with a keel or ridge.

Cinereous, ash-colored.

Clavate, club-shaped, enlarged towards the end.

Claws, the pair of hooks at the end of the feet.

Clypeus, the anterior margin of the head.

Compressed, flattened laterally.

Confluent, running into one another.

Contiguous, touching each other.

Coriaceous, like leather, hard, but flexible.

Corrugated, wrinkled.

Coxa, the basal joint of the leg, (plural *coxæ*.) See pages 14 and 27.

Crenate, scalloped.

Cylindrical, long and round, of the same thickness throughout.

Decumbent, bending down.

Deflected, bent down.

Dehiscent, gaping, separated at the tips.

Dense, thickly crowded.

Dentate, furnished with acute teeth.

Depressed, flattened downwards. Compare with *compressed*.

Diffuse, spreading, not distinctly circumscribed.

Digitate, finger-like, divided like the fingers nearly to the base.

Disk, the upper middle part of a given surface.

Distant, standing considerably apart. Compare with *remote*.

Divaricate, spreading apart.

Dorsal, relating to the back.

Elliptical, elongate-oval.

Elytra, the wing-cases.

Emarginate, notched.

Entire, whole, not indented at the end or margin.

Explanate, spread out, flattened, with a broad, thin margin.

Exserted, protruded, exposed to view.

Exterior, outer, outside of.

Exuviæ the cast-off skin.

Falcate, sickle-shaped.

Fascia, a colored band, running croswise.

Fascicle, a bundle.

Femur, (plural *femora*,) the thigh. See pages 14 and 27.

Ferruginous, yellowish-red, like the rust of iron.

Filiform, thread-like, slender, and of equal thickness.

Flexuous, waving, zig-zag.

Fulvous, tawny, reddish-yellow.

Fuscous, dark grayish-brown.

Fusiform, spindle-shaped, tapering at both ends.

Geniculate, elbowed, bent abruptly.

Genus, an assemblage of species, or sometimes a single species, possessing peculiar and distinguishing organic characters.

Glabrous, smooth, without hair or down.

Granulated, covered with small grains or minute rounded elevations.

Gregarious, living in society or flocks.

Habit, in the singular number is used scientifically to express the general aspect of an insect, independently of particular characters; but in the plural, *habits*, it has the ordinary signification of manners or modes of life.

Heteromerous, having five joints in the anterior and middle tarsi, and four joints in the hind ones.

Hirsute, clothed with stiff, erect hairs.

Humerus, the anterior and outer angle of the elytra.

Hyaline, transparent.

Imago, the perfect insect, after it has passed through its preparatory transformations. See page 8.

Imbricate, lapping over like the shingles on a roof.

Immaculate, without spots.

Immarginate, without an elevated rim or margin.

Incision, the line of separation between the segments of the abdomen.

Incrassated, thickened.

Incumbent, lying upon.

Interrupted, broken, not continuous.

Involute, rolled inwards.

Irrorate, marked with minute points.

Labial palpus, the little jointed appendage attached to the labium. See pages 12 and 27.

Labium, the lower or posterior lip. See page 11.

Labrum, the upper or anterior lip. See page 11.

Lamella, a thin plate; *lamellate*. See page 11.

Larva, literally *a mask*, the state of an insect next following the egg state. See page 8.

Lateral, on the side.

Laterally, side-ways.

Lateritious, brick-colored.

Ligula, the tongue. See page 12.

Line, in measurement, the twelfth of an inch; in marking, a very narrow stripe.

Linear, long and narrow, and of equal width.

Longitudinal, lengthwise.

Lunate, half-moon shaped.

Luteous, deep yellow, like the yolk of an egg.

Macula, a colored spot.

Mandibles, the upper or anterior jaws. See pages 11 and 27.

Maxillæ, the lower or posterior jaws. See pages 11 and 27.

Maxillary palpus, the little jointed appendage attached to the maxilla. See pages 12 and 27.

Mentum, the chin.

Mesosternum, that part of the breast to which the middle legs are attached. See figure on page 27.
Metasternum, the hindermost section of the breast, to which the hind legs are attached. See figure on page 27.
Moniliform, like a string of beads.
Mucronate, terminated abruptly in an acute point.
Necrophagous, feeding on dead animals or carrion.
Normal, of the usual form, not exceptional.
Ob, prefixed to a word reverses the position.
Obcordate, inversely heart-shaped, that is, heart-shaped, with the point directed downward or backward.
Obovate, inversely egg-shaped. See *Obcordate.*
Obsolete. undeveloped, indistinct.
Obtuse, blunt.
Occiput, the hinder part of the head.
Ocelli, the single eyes. See page 5.
Oculi, the compound eyes. See page 6.
Orbicular, round and flat, applied to a surface.
Oval, somewhat egg-shaped, but with the two ends alike.
Ovate, egg-shaped, one end being narrower than the other.
Oviduct, the instrument for depositing the eggs.
Ovum, plural *ova*, an egg.
Palmate, hand-shaped, cut in about half way to the base, like the fingers of the hand.
Palpus, plural *palpi*, little jointed appendages to the mouth. See pages 12 and 27.
Parallel, having parallel sides of equal width throughout.
Parasitic, inhabiting another animal, or living at its expense.
Pectinate, comb-toothed.
Pectus, the breast.
Peduncle, a stalk or petiole.
Pedunculated, attached at the end of a peduncle.
Pentamerous, having five joints in all the tarsi.
Penultimate, the last but one.
Perfoliate, composed of transverse flattened joints, with the axis passing through the center.
Petiolated. See *pedunculated.*
Piceous, pitch-colored, reddish black.
Pilose, clothed with long flexible hairs. Compare with *hirsute.*
Poisers, or *halteres.* See page 13.
Proboscis, the sucker.
Procumbent, lying flat. Compare with *decumbent* and *incumbent.*
Prosternum, the fore part of the breast, to which the anterior legs are attached. See page 27.
Pubescent, downy, coated with almost microscopically fine hair or down.
Punctured, marked with small impressed points or dots.
Pupa, an insect in the chrysalis state, or that following the larva.
Quadrate, square-shaped or nearly so.
Remote, standing far apart.
Reniform, kidney-shaped.
Reticulate, like net-work.
Rostrum, a beak, or prolongation of the head.
Rufous, light-reddish.
Rugose, wrinkled.
Rypophagous, filth-eating.
Salient, projecting, prominent.
Saltatory, leaping.
Scrobe, the furrow on the side of the rostrum of the snout-beetles for the reception of the antennæ.
Scutellum or *Scutel*, the top of the mesothorax, forming in the Coleoptera the small triangular piece between the bases of the elytra.
Securiform, hatchet-shaped, broadly triangular.
Sericeous, clothed with a fine silken pubescence. See *Pubescent.*
Serrate, saw-toothed. See page 11.
Sessile, attached by the whole width, not pedunculate.
Seta, a bristle.
Setaceous, bristle-like, slender and tapering.

Sinus, a hollow; a rounded notch.

Sparse, scattered, opposed to *dense*.

Spinous, armed with spines.

Spiracle, a breathing pore.

Sternum, the breast, or under side of the thorax.

Stria, plural *Striæ*, an impressed or sunken line.

Striate, marked with striæ.

Sub, prefixed to a word diminishes its meaning, equivalent to ***somewhat***.

Sub-clavate, somewhat or moderately club-shaped.

Sub-cortical, living under bark.

Subulate, awl-shaped.

Sulcated, grooved.

Tarsus, the jointed foot of insects. See page 14.

Tergum, the upper side of the abdomen.

Terminal, situated at the extremity.

Tessellated, chequered.

Testaceous, pale brick-colored.

Tetramerous, having four joints in all the tarsi.

Thorax, the middle division of the body.

Tibia, the shank, that part of the leg between the thigh and the tarsus.

Tomentose, clothed with matted hair.

Transverse, cross-wise.

Transversal, having the width greater than the length.

Trimerous, having three joints in all the tarsi.

Trochanter, an appendage to the base of the thigh. See page 27.

Trochantin, a small accessory or supernumerary joint sometimes interposed between the coxa and the femur, in the anterior and middle legs.

Truncate, cut off square at the tip.

Tubercle, a little swelling or prominence.

Venter, the under side of the abdomen.

Villose, or *villous*, clothed with long soft hair.

Vitta, a colored stripe running lengthwise. Compare with ***fascia***.

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